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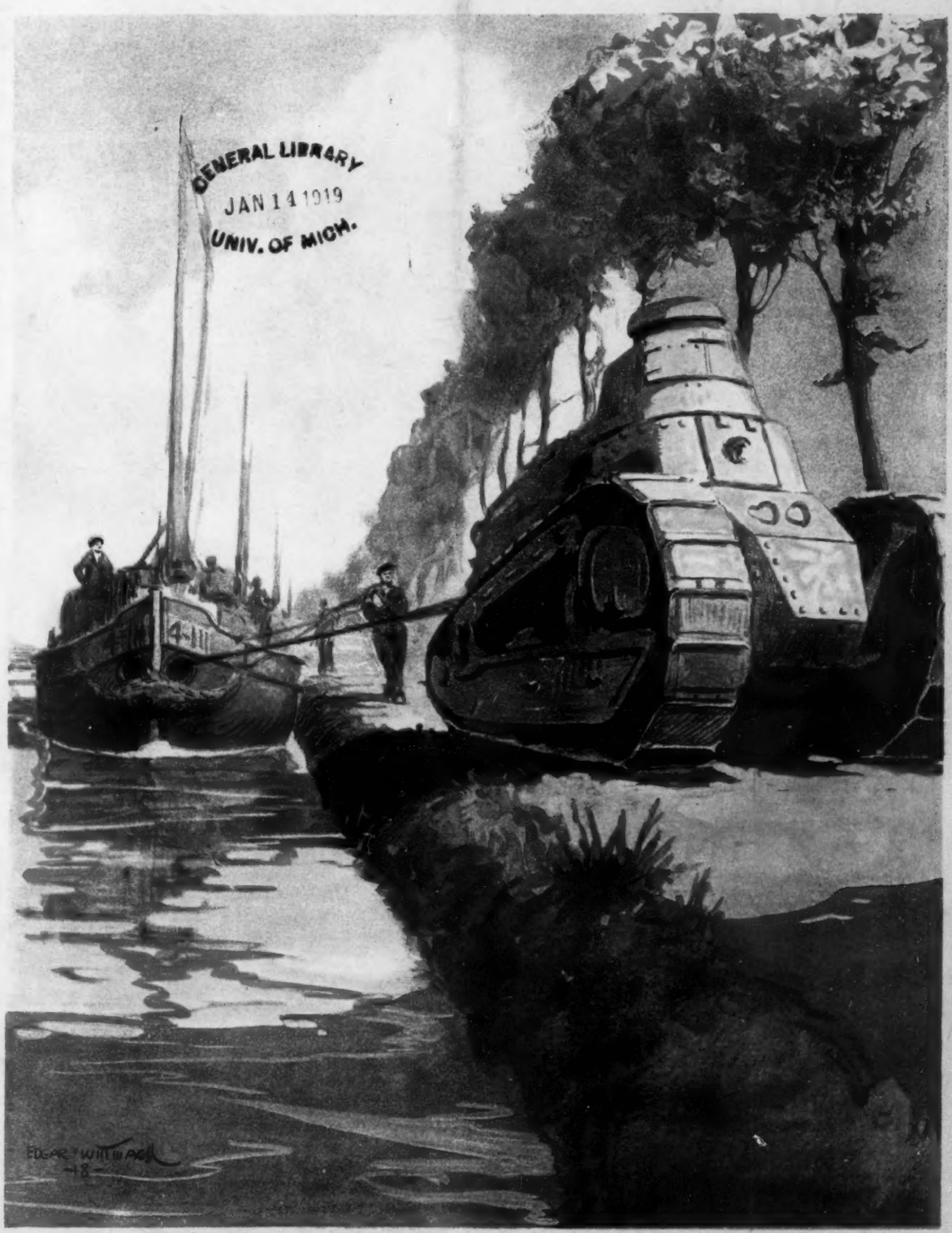

TOWING CANAL BARGES—A PEACE-TIME OCCUPATION FOR FRENCH BABY TANKS

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January 11, 1919

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SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXX. NUMBER 2] NEW YORK, JANUARY 11, 1919 [10 CENTS A COPY $5.00 A YEAR

Railroad Ferry Service Between England and France

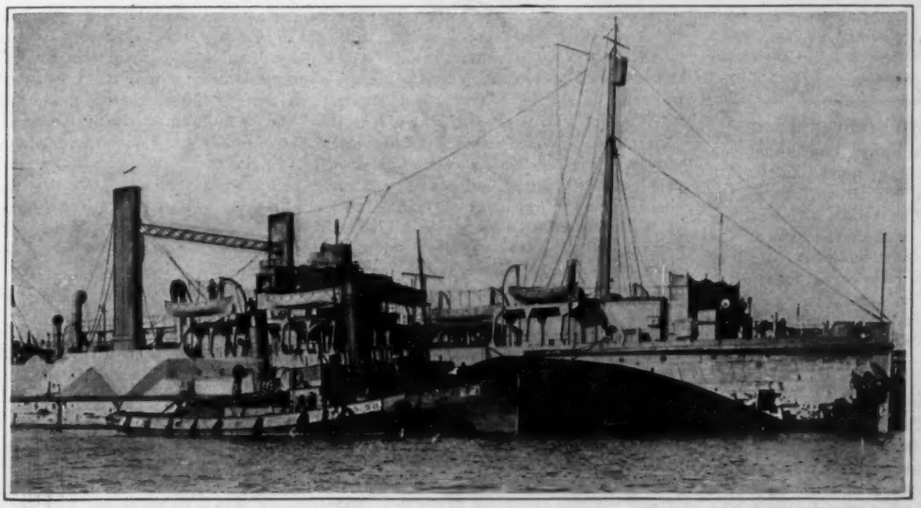
ONE of the carefully-guarded secrets of the war was the construction at Richborough, on the south coast of England, of a large fright yard and railway terminal ferry for the transfer of loaded trains between England and France. So well was the location concealed that this important link in the cross-Channel communications was never subjected to bombardment by airplanes or Zeppelins.

The terminal which is known as Richborough is located near the coastal town of Sandwich, and was built upon land which, three winters ago, was a favorite resort of the coot and the heron, and was used, in part, for the pasturing of sheep. The site selected included about 2,200 acres, and in addition to a large railway storage and classification yard, with the usual tracks and storage buildings, there was constructed an extensive plant for the construction of barges. The magnitude of the Richborough terminal works may be judged from the fact that at the close of the war its personnel included 20,000 officers and men.

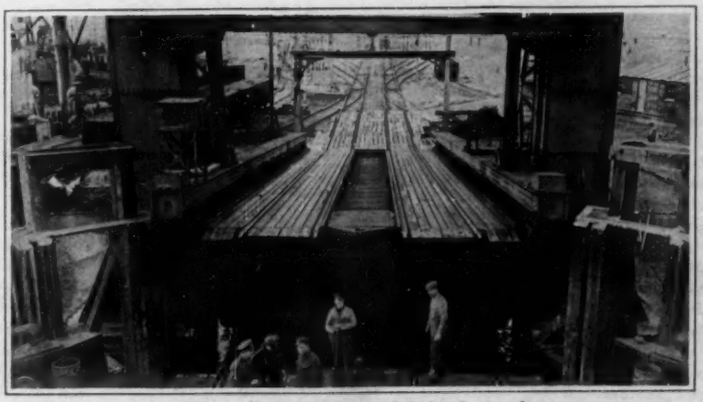
For the train ferry service, three steel ferries were constructed of the type shown in our illustration. These vessels are 363 feet long by 61 feet in beam, with 10 feet of draft, and their speed is 12 knots. Their displacement is 3,655 tons and they are driven by twin screws. They are provided with four railroad tracks running the length of the ship, which are capable of holding fifty-four 10-ton trucks. To accommodate the rise and fall of the tides, movable ferry slips were provided at each terminal. The trains were run directly on to the ferry and at the terminals at France were hauled ashore and taken direct to their destination. When the ferries were not loaded with freight trains, they were used for the transportation of locomotives, tanks, artillery, and other similar supplies for the fighting front.

The service was started in full swing on the 1st of February, 1917, and from that time to the signing of the armistice, it had carried across 1,285,000 tons, of which 785,000 tons consisted of guns, gun shells, and other ordnance material.

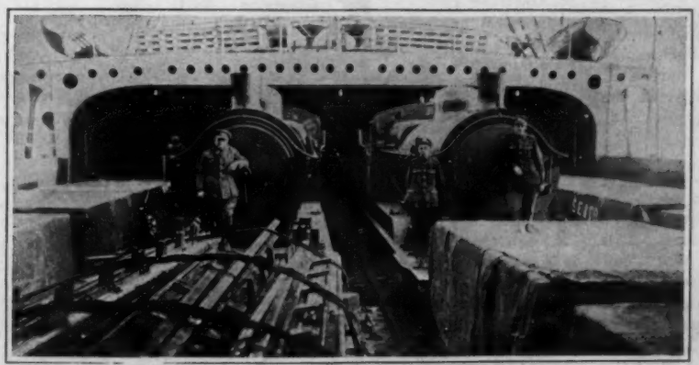
We have referred above to the steel barge building yard which formed part of the Richborough plant. A large number of barges were constructed here and, in connection with the ferry service, a total of 232 steel barges and 50 tugs were in constant operation. The barges were so built that they could pass without unloading or lightering through the canal system of France, which extended right into the fighting front.



One of the railroad ferry-boats, built for cross-Channel war service. Carries 54 cars at 12 knots



The ferry-slip at Richborough being lowered to level of ferry deck



Deck of the cross-Channel ferry loaded with freight trains

It should be mentioned that each of the ferry-boats carried four anti-submarine guns of three-inch caliber, two mounted at each end of the boat. In addition to Richborough, there was another terminal on the English side of the Channel at Southampton. Ferries from Richborough ran to Calais and Dunkirk and the service from Southhampton ran to Dieppe.

The Effect of Altitude on the Eye

A CAREFUL study of the effect of altitude on the eye, was made at the Research Laboratory at Mineola, L. I., in order that the complex practical problems could be more scientifically dealt with, according to Capt. Conrad Berens, M.C., U.S.A., writing in *Plane News*. Sight accommodation (the power to see clearly objects close to the eye), convergence (the power to keep the gaze of both eyes fixed on an approaching object), the field of vision (power to see laterally when the gaze is fixed straight ahead), the finer color discriminations and stereopsis (the power to judge depth and distance), all showed weakening, due to the effect of altitude, the changes occurring at varying altitudes in different subjects.

Should goggles be worn? In our opinion, continues Capt. Berens, they undoubtedly should be worn if a properly constructed and ventilated goggle with a perfect field of vision and good optical glass can be obtained. Goggles are a great protection in the wind, as their use prevents tearing and inflammation of the lids, and also prevents hot water or oil from striking the eye.

It is also important that there should be not too large a bar between the eyes, as this may interfere with the use of both eyes in the judging of distance. Colored lenses are a great help, but it is better to wear them only when absolutely necessary, as when flying toward the sun, in a fog, above the water, or in the case of pilots whose eyes are unusually sensitive to light. If colored lenses are worn one should always have a pair of goggles with white lenses ready for instant use. Triplex goggles are some protection, although chips of glass fly off the posterior surface and the resisting material, placed between the two glass surfaces, deteriorates with age and becomes less transparent.

If a man is flying every day without the artificial use of oxygen, he should have his eyes examined every month, as the ocular condition is also an index of general physical fitness. It is important to have an immediate ocular examination if the aviator is landing badly, having trouble in seeing clearly or in judging distance; for a few days' treatment may be the means of preventing the wrecking of a plane or a more serious accident.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

New York Subways Must Be Readjusted

THE new system of subways, including two fundamental lines extending north and south through Manhattan and the Bronx, one on the West Side and the other on the East Side, with a system of shuttle trains supposed to connect the two at 42d Street, has been in operation for a sufficient length of time for the traveling public to form an estimate of its convenience and efficiency.

We feel confident that we are voicing the practically unanimous opinion of the people of New York, in which we heartily concur, when we state that the present arrangements are exceedingly inconvenient.

A passenger coming down from the upper West Side, who wishes to cross over to the lower East Side line, or vice-versa, has to alight from the train at Times Square, follow a long and confusing course through the station to the shuttle train, and on arriving at the old Grand Central Station, he has to climb the stairs and take another long walk before he can get into touch with the East Side line. Even to the passenger who has made the trip and is familiar with it, the delay and the congested crowds are, from a business point of view, a nuisance, and incur a very considerable loss of time. In other words, a truly magnificent system of rapid transit is delayed, interrupted, and, to any but regular users, that is to say to many, many thousands of visitors to the city, is rendered extremely confusing.

In considering this problem we must not be unjust. It cannot be denied that in the neighborhood of 42d Street there is a great congestion of underground lines, and beyond question the Public Service Commission and its engineers had a very difficult problem to work out at this point. But, seeing that they had determined upon a shuttle service, they should have made it a *sine qua non* that the shuttle-train tracks at each end of 42d Street terminate alongside the platforms upon which the cross-over passengers are discharged.

Something must be done to restore the system to its full efficiency. The obvious plan is to build another connecting subway through one of the cross-town streets in the neighborhood of 42d Street, using the present 42d Street line for the trains which convey passengers from the upper West Side to the lower East Side, and using the other cross-town subway for traffic from the upper East Side to the lower West Side. Such an arrangement would restore all the greatly appreciated advantages of the old system, and would avoid the present troublesome break in the journey.

A Good Job, Well Done

WHEN war was declared, the technical men of this country who were unable to go to the front demanded some means whereby they could share in the prosecution of our cause. This feeling resulted in the organization of the War Committee of Technical Societies. The functions of this body were to assist in bringing the engineering resources of the country to bear upon the technical problems of the war.

The Committee was organized by joint action of the leading technical societies. The appropriations from these societies were too small to support efficient work; so the Committee accepted an offer from the Naval Consulting Board, by which it agreed to coöperate with the Board in return for offices, telephone service, and postal privileges.

The first fruits of this admirable arrangement were joint bulletins of the Board and the Committee on "The Enemy Submarine" and "Problems of Airplane Improvement." These bulletins placed before the engineers of the country, in concrete form, the fundamentals of these two important fields of war invention. They told what had been done, what had been tried without success, what was wanted; they resulted in a much improved class of suggestions over what the Board theretofore been receiving.

But it was not contemplated that the engineering problems of the war be dealt with entirely by voluntary offerings of the public. During the prosecution of hostilities, new problems of all kinds were constantly coming up, both in the army and in the navy. These were problems which the army and navy engineers, by virtue of their very specialization, were not qualified to attack to best advantage; and on the other hand, there seemed no effective agency to exist whereby such problems might be referred to the men equipped to solve them. It appeared, therefore, that the War Committee, with its technical affiliations, could meet a very real need by acting as a go-between to bring the problems of the army and the navy officially before the engineers and technicians best qualified to deal with them.

At first there was a hitch in this arrangement. There was no go-between to bring the problems of the army and the navy before the Committee; and the latter found it difficult to get hold of these problems at long range. This situation was met by quartering the Committee with the navy, and by appointing, in the army, a "liaison officer" part of whose business was the keeping open of communication between the Committee and the military chiefs.

All this turned out admirably. The problems of army and navy began to get properly before the Committee, in all their bearings; and the Committee was invariably able to analyze them sufficiently to refer them to just the right place for solution. Some were suitable for general distribution to all members of the engineering community, through bulletins and letters; some, of a semi-confidential nature, went only to selected individuals who were known to be interested in the class of work involved; and a certain few, secret to the last degree, required the higest order of technical qualifications, to be found only in carefully selected scientists and inventors whose whole life-work had fitted them for the investigation in hand. Its success in the handling of these last cases alone would have been sufficient justification for the life of the Committee.

Of course, the Committee did not operate without friction. It had to learn how to discharge its functions by discharging them, and learning from its mistakes. It made plenty of these, but seldom or never the same one twice. And it was just getting into its stride, and bringing the whole weight of our technical man-power squarely into the fight, when the bottom fell out of the war, and left the Committee without a job.

This little notice is, in fact, an obituary. On December 31st the War Committee of Technical Societies ceased to exist. It had done its work well; it was responsible even more than can be adequately realized from so close by, for the thoroughgoing participation in the war of American invention and engineering. And though its members may have feelings of regret that what must appeal to them as the untimely collapse of the foe should have robbed them of the satisfaction to be derived from witnessing the full fruition of their labors, the Committee at least goes out of business with the satisfaction of having done all that was asked of it—and a little more.

Getting Rid of German Shackles

IN the flood of lamentable nonsense that has been let loose of late in the American press on the subject of German science and German scientific literature it is a joy to meet with the opinions of the few persons, here and there, who, though in no sense apologists of Germany, possess a first-hand knowledge of their subject and brains unbefogged by fanaticism. Such a person is Prof. Edwin Bidwell Wilson, of the Massachusetts Institute of Technology. Writing in *Science* on the subject of "Insidious Scientific Control," Professor Wilson hits the nail squarely on the head when he undertakes to point out just in what way the scientific literature of Germany *is* superior to that of other countries, and the direction in which the rest of the scientific world must bend its efforts if it would secure freedom from German intellectual shackles.

So far as the public at large is concerned, the issue has been deplorably confused by reiterated statements to the effect that Germany has never surpassed, or perhaps has never equaled, certain other countries in the task of adding to the world's stocks of valuable knowledge. In the field of creative science, we are told, German achievements have been grossly overrated. Let us grant this contention with alacrity. What then?

The policeman on his beat, the cab-driver on his box and the provinical politician on his stump may be pardoned for believing that a nation which is not prolific in scientists of the first rank is not capable of turning out particularly valuable scientific textbooks and reference books. Nobody who uses such books, however, should fall a prey to this fallacy. The best didactive scientific books are almost never written by the leaders in scientific thought and the pioneers in scientific investigation. They are written by persons who have a talent for exposition and unflagging industry in assembling knowledge wherever available, and who, as often as not, have never made a single scientific discovery.

Just how have German publications acquired their undeniable hold upon the minds of well-educated scientific workers throughout the world? It is idle to talk of propaganda. The modern business man is well aware of the narrow limitations of advertising that does not rest upon merit in the goods advertised; and propaganda is merely another name for advertising.

Professor Wilson has supplied a partial answer to the foregoing question. It is found in the everyday law of competition. He says:

"The fact is that any scientist must have the means himself readily to look up the literature on any scientific subject; and the fact is that the great compendiums of science, the great yearly reviews of scientific progress, are made by Germans, and published in the German language. It is impossible for a mathematician to work to advantage without being able to consult the *Jahrbuch für Mathematik*. It is impossible for physicists to work without consulting the *Fortschritte der Physik; Science Abstracts* are not sufficient. And so it is in many other fields of science."

Every cosmopolitan scientific man will be able to make many additions to this list. The *Minerva Jahrbuch* is the one and only first-rate international directory of scientists and scholars. The *Geographen-Kalender* is indispensable within the field of geography and contiguous sciences. No British or French atlas approaches Stieler's in workmanship and accuracy. But the list is endless.

The business of making scientific discoveries is one thing; the business of recording them, summarizing them, rendering knowledge of them available, is quite another. In this latter field Germany has had no serious rival; and at the present writing *no other nation manifests any serious intention of taking her place.*

The workings of competition will not long be hampered by sentimental considerations. Unless non-Germans can produce as good dyes and drugs, textbooks and reference books, as those made in Germany, we shall inevitably lapse into economic and intellectual subjection to the Germans. It will not help the situation to harp upon irrelevancies.

German monopolies have not been good for the world at large, nor, indeed, for Germany herself. Her commercial monopolies have been shattered by the war. Whether they can ever be reëstablished is problematical. The particular kinds of intellectual monopoly of which we are writing can only be said to be in abeyance. We hear that British and American manufacturers have solved the dye problem and the glass problem. We do not hear that any publisher has produced an American equivalent of Stieler's "Hand-Atlas" or a British equivalent of Winkelmann's "Handbuch."

Let us hope for the best. The English-speaking world is more populous than the German-speaking world, and the English language, with its Germanic base and its Latin superstructure, is particularly well qualified to become the international language of science. These are excellent reasons why books indispensable to students and scholars should be printed in English rather than in German.

Electricity

Why Not Larger Trolley Wheels?—In the *Electric Railway Journal* some account is given of the experience of the Oakland, Antioch and Eastern Railway with 10-inch trolley-wheels. Formerly 6-inch wheels were used, the trolley pole tension being 35 to 40 pounds, and the life under those circumstances was only about 900 miles. By using 10-inch wheels the tension can be reduced to 25 to 30 pounds, and a life of 6,000 miles or more is obtained. In addition, various incidental maintenance troubles are diminished.

Naval Control of Wireless.—The Navy Department has purchased all of the radio stations except four high-power stations of the Marconi Wireless Telegraph Company of America. The stations sold by the company are 45 in number, of which 19 are on the Atlantic and Gulf coasts, 16 on the Great Lakes and 10 on the Pacific Coast. The Navy Department has purchased from the Alien Property Custodian the radio station at Sayville, L. I., formerly controlled by German interests and intended for transatlantic wireless traffic.

Marconi's Improved Radio Transmitter.—The apparatus developed by G. Marconi for the production of continuous oscillations by overlapping wave trains has proved most effective for long-distance communication at high power. It has done away with many of the intricate mechanical and electrical problems encountered in the construction of radio-frequency alternators and arc transmitter systems, according to the *Electrical World*. Moreover, it makes an apparatus capable of generating damped oscillations at any spark frequency desired.

Dielectric Loss in Condensers.—In a contribution to the *Zeitschrift des Oesterr Ingenieur und Architekten-Vereines*, Dr. Grunberg describes some tests on glass, hard paper and mica condensers at a low frequency. With glass the efficiency diminishes with increasing frequency. A rise in temperature also causes a marked increase in the losses, which increase rather more rapidly than the square of the pressure applied. With hard paper a more marked drop in power factor occurs with diminishing frequency than in the case of glass, while with mica the contrary effect is noted.

Wind Driven Dynamos.—An account was recently given in *Ingenioren* by Mr. H. C. Vogt, of some experience of the utilization of wind power for driving dynamos. The mills described had sails 100 feet in diameter and an area of 3,930 square feet. With a mean wind velocity of 24 feet per second, 290 horse-power was obtained. Power is transmitted from the main shaft by a series of cog wheels with the spokes in tension; rope and chain gearing were found not to answer. By means of gearing the speed of the main shaft, 12½ revolutions per minute, is increased to 1,500 revolutions per minute for the dynamo.

Electric Heater for Medicinal Solutions.—In warming solutions for medicinal purposes it is often essential that an even temperature be maintained, according to *Electrical World*. With this end in view an American concern is now making an electric heater which incloses the tubing carrying the solution from the supply to the point of application so that as the solution is needed it is heated to an even temperature. By using a light-dimming socket in conjunction with the heater it is possible to lower or raise the temperature of the solution by varying the amount of current fed to the heater. Connecting plugs and cord are supplied with the heater.

Insulator Failures.—A power company operating in the State of Georgia has recently changed over all the strain insulators on one of its lines as a means of reducing insulator failures. Operating reports of the company showed that 30 per cent of the insulators were defective. The cause of the large number of defective insulators was found to be on account of the combined influence of the elements, the position of the insulators, and their design. Unequal expansion and contraction of metal parts, of porcelain and cement, played a part in the failure, but the chief cause was due to the insulators being installed in a horizontal position, their 'under sides' thus being exposed to sun and rain, and at the same time acting as pockets for the accumulation of dust and dirt. By changing the type and position of the insulators for a vertical arrangement an umbrella effect is obtained which overcomes the trouble previously mentioned.

Science

In Honor of Leonardo da Vinci.—The fourth centenary of the death of Leonardo da Vinci will be celebrated next year in Italy by the publication of a "national edition" of his works, including material never before published. Leonardo was the greatest scientific and mechanical genius of his time, and the new critical edition of his works will doubtless find a place in all large scientific and technical libraries.

Fake Cures for Consumption.—According to the National Association for the Study and Prevention of Tuberculosis, no less than $20,000,000 is invested in the business of making and exploiting fake cures for consumption in this country. About $5,000,000 per annum is spent in advertising these nostrums and the net profit is estimated at $10,000,000 per annum. This is properly described by the Association as "blood money."

Sengite.—Under this name, which is derived from the initial letters of the words "Substitute explosive, no glycerine," with "ite" added in imitation of the word "dynamite," a new explosive is being manufactured in South Africa, to meet the growing shortage of nitroglycerine explosives. According to a consular report, it has a guncotton base and is similar to tonite, except that nitrate of soda is substituted for nitrate of barium. It is found that by this substitution an explosive of approximately the same strength as gelignite can be produced. The new explosive is said to be so insensitive to shock that it may be safely hammered with a steel tool. If used in mining, explosions would not be caused by drilling into unfired holes. It has already been thoroughly tested in a number of mines and found satisfactory.

Adenoid Clubs.—Under this name the state board of health of North Carolina, in its Health Bulletin, describes a new plan whereby surgical treatment is provided at moderate cost to children suffering with diseased tonsils, excessive adenoid growth, and kindred disorders. In the medical inspection of schools many cases of this kind are constantly found. Simply to notify the parents proves woefully inadequate, owing to the expense of an operation, the necessity, in many cases, of taking the child away from home, and a general spirit of inertia. The new scheme, which has been tried with much success in various parts of the state since 1914, involves engaging the services of an expert operator, who visits a particular locality on a day previously announced, bringing complete equipment and a trained nurse, and operates on as many as 15 children in the course of the day. A temporary hospital is installed at a local hotel, and local physicians are engaged to look after the patients until they "come round" properly. By this plan the expense to the parents able to pay for the operation is reduced to $12.50 per child, and children of poor parents pay nothing.

Fixing the Responsibility for Diphtheria Fatalities.—The State Laboratory of Hygiene of North Carolina has recently undertaken the distribution of diphtheria antitoxin practically free of cost to the people of the state. The charge for a package of antitoxin, irrespective of its size, whether it contains 1,000 units or 10,000, is 25 cents, which is merely to cover the value of the accompanying syringe and wrappage. At the same time the state board of health has adopted the policy of seeking to fix the responsibility in cases of death from this preventable disease. It is proposed, at the outset, to make a careful investigation by personal visit of a trained epidemologist in one hundred cases of death from diphtheria in various parts of the state. With very few exceptions children die from this disease because antitoxin is not promptly administered in proper amounts. Less than two per cent die if thus treated during the first two days. Responsibility for the the fatal cases may lie either with (1) parents, who delay summoning a physicain when suspicious symptoms present themselves, or with (2) physicians who fail to administer antitoxin promptly to patients and persons exposed to the disease and not shown by the Shick test to be immune, or with (3) the local health officer, for failing to see that a supply of antitoxin is at all times available in his vicinity. The state board of health proposes to publish hereafter in its monthly *Health Bulletin*, details of fatal cases and to point out, so far as possible, just who was responsible in each case.

Industrial Efficiency

A New Dutch Industry.—A factory has recently been installed in Holland for the manufacture of sacking, carpets, and even fine fabrics from plant fibers, by means of a new process. Great quantities of vegetable fiber is now being accumulated for the purpose.

Hemp Braid Dye.—Heretofore the inability of the Japanese to dye successfully hemp braid, which is exported to the United States and England for trimming on women's hats, has stood in the way of an even larger business being done in this article. However, a report has been received from Japan to the effect that a Japanese chemist has invented a process whereby the dyeing may be done uniformly.

Steel Band as a Substitute for Leather Belt.—The scarcity of leather brought about by the war has made it necessary to find a substitute for that material, particularly in the case of belting. At the Ickern mine in the Herne mining district in Germany, a steel band is being used to replace a leather main driving belt 52 feet in length and 7 inches in breadth. The width of the band is only 3 inches, and the ends are joined by means of small screws. The driving pulley has a diameter of 3 feet. The cost of the band was about $65. Though, from some undiscovered cause, this band gave way near the joint, the mine authorities, in view of the many advantages of the steel band, have decided to repeat the experiment.

Numerous Jobs for Cripples.—A recent canvass undertaken by officials of the Ford Motor Company plant at Detroit for the purpose of ascertaining how much of the work at that point could be handled by cripples, revealed the following interesting information: Jobs that could be filled by legless men, 670; by one-legged men, 2,637; by one-armed men, 715; by totally blind men, 10. The time required for cripples to become expert at these jobs is estimated for 1,743, one day or less; for 1,461, one day to one week; for 251, one to two weeks; for 534, one month to one year; for 43, one to six years. About 18 per cent of all the employees at the Ford plant at the present time are said to be cripples or physically substandard. Eighty-five per cent of them, however, are classed as fully efficient workers.

Lemon Drops for Our Army.—When our draft armies first came into training, it was found that the lemon drop was a favorite candy among the men. It was found also that most of the commercial lemon drops were made of glucose, flavored not with the fruit but with an acid imitation. The military authorities obtained samples of lemon drops from practically all the candy makers in the country, analyzed these, chose the best one, obtained the formula for its manufacture, and distributed orders for a supply of lemon drops to be made according to the accepted recipe. Consequently, the soldiers are now being supplied with a lemon drop that is made of pure granulated sugar, and flavored with an emulsion from the rind of the lemon. This confection has the thirst-quenching quality of good lemonade. And it is being used by the soldiers at the rate of 200,000 pounds a month.

The Danger of Empty Gasoline Tanks.—Seemingly empty gasoline tanks or cans are at all times more dangerous than those filled with gasoline. Usually the can will not be entirely emptied and the remaining gasoline will vaporize, the vapor will mix with the air in the can, and the mixture may easily be explosive. When the can is being filled this mixture is forced out by the gasoline and may explode if ignited by a flame or spark near the opening. Many engines are built with cavities or inclosed spaces in the crank case, base, or some other part, and these may be full of gasoline vapors. When inspecting or making repairs with an open light, men have been severely burned when the light vapors ignited. To guard against such accidents, all cavities should be blown out with compressed air or steam. If neither is available the cover should be removed, the vapors fanned out, and a lighted lamp or candle, attached to a stick, passed around inside the cavities to burn out any vapors that may remain in the cavities. Unless an ample current of air at considerable velocity is passing, gasoline should not be used to clean an engine or other machinery. Even if there is sufficient air to sweep away the vapors as soon as they are given off open lights should always be kept a safe distance and on the intake side so that the vapor cannot be carried to the light.

Cibola Revealed

Relics of Coronado's Seven Cities in a New York Museum

By John Walker Harrington

SCIENCE and romance give attest to the Seven Cities of Cibola and the Kingdom of Quivara, of which the good Friar told while sitting in the baber's chair. That was a long time ago, to be sure, and the knights who fared across the American desert have long since gone to their fathers; as to the great Coronado himself, his good sword is rust this many a year.

We have almost forgotten Cibola, you and I—the last four years and half of war would have driven archaeology out of the heads of even the zealots who revel in the past: and yet after all what a name is Cibola with which to conjure! Now that the Government has no more need of withholding from peaceful uses the bronze and steel and glass from which showcases are made, the Museum of the American Indian, in New York city, will be able to display the riches of Cibola to the public. Scorces of heavy packing cases laden with them are already waiting in the basement, and perhaps soon we shall have the chance to see the relics of that venerable town stormed in 1540 by the Spanish conquerors.

Wherefore let the archaeologist and the historian rejoice together over this notable collection, from which they may learn so much, and let the layman also be glad that he may see for himself what Don Francisco de Coronado and his followers got for all their privations and their pains.

The riches of Aztecs and the Incas, which came so easily into the treasure chests of Spain, filled the adventurers of the early sixteenth century with the belief that all the New World was running over with treasure more precious than the wealth of Ormusd and of Ind. When it was proposed to explore the realm to the north of Mexico, Cortes, de Soto, and others sued with the Spanish court for the privilege and they fought each other in the tribunals as well. The more they quarreled about the lands still unseen, the more were they convinced that gold and silver and precious stones could be had for the taking.

Under the direction of Viceroy Mendoza, you will recall, the intrepid Coronado set forth from Compostella in February, 1540, to annex the Province of Cibola and the kingdom of Quivara. Strange, high sounding names were these—given to what is now the Southwest of these United States. They were based on the language of the Indians, and gradually, so many were the tales which the aborigines had told, the Spaniards came to believe all that their avarice dictated concerning the mysterious settlements beyond the border. True, they had sent as a scout, the good Friar Marcos de Niza, who, fearful that he would be murdered as had his negro guide, viewed the first city of Cibola from a good safe distance. There is more than distance to lend enchantment to the walled and terraced towns of our Southwest, for the friar must have felt what he said when he made affidavit later that the first of the cities of Cibola, which we call Hawikuh, was larger than the City of Mexico itself. The magic of the mesa and of the wide spaces of the Southwest had him in thrall, and small wonder was it that he repeated as true many of the details of the wealth of the people which had been told by the ebony guide who had preceeded him. Afterwards, when the friar came upon calmer days, and was under the ministrations of the knight of the razor, he undoubtedly told no more than was really so when he spoke of Cibola as the city which was surrounded by walls, with guarded gates; where there were goldsmiths and silversmiths; where the women had golden beads and the men girdles of gold; and where there were sheep from the fleece of which were woven garments of pure white "and where the people slaughtered birds and also had images of iron."

Zuni Indian workmen employed in resurrecting the relics of their ancestors

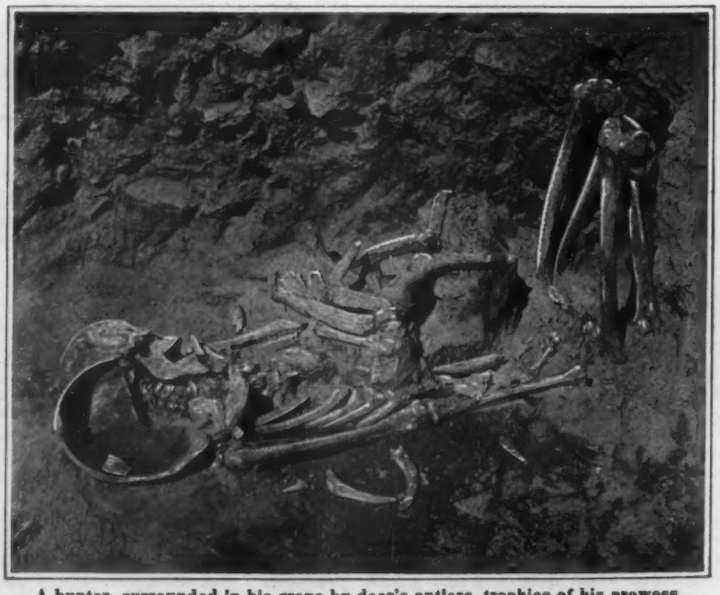
The story of the march of Coronado loses none of its interest nor does it dwindle in its importance, through the discovery of the document among the Spanish Archives which shows that, five years earlier, Cabeca de Vaca had traveled the old Santa Fe trail in the quest of the Golden West. Coronado will always be associated, as the real pioneer, with these early chapters of the history of the Southwest; for undoubtedly the effects of his expedition, the most extensive ever made within the borders of the United States, have been far-reaching.

With 300 picked men, the most of them mounted and encased in armor and carrying their great lances in rest, and attended by hundreds of burden bearers, the army proceeded. It discarded or sent back many of its heavy trappings and superfluous baggage, and it was reduced to the lightest possible marching order when, in the heat of August, it reached the first city of the quest. Indeed, when the natives resisted the design of the conquerors to take everything in sight, a sorry and feeble brigade it was which attacked them. The invaders were nearly famished. The cross-bowmen and the harquebusiers were so weak that they could hardly move, and the arms of many of them were out of commission. The men of Hawikuh, fighting from the house tops of the wall town, threw huge stones with such accuracy that they overwhelmed many of the exhausted Spaniards. Coronado, a conspicuous target by reason of his shining gilded armor, was twice knocked down and would have been killed had he not been dragged away by one of his aides. The natives finally surrendered, however, and the adventurers occupied the town. Once in the houses they found abundant food which satisfied them so well, that for days they were gladder to have had it than silver and gold. The town was abandoned entirely by the Indians, who went to neighboring settlements and left the Spaniards in control.

Disappointed in not finding the wealth on which he had set his heart, Coronado none the less continued his explorations, and he and divisions of his party penetrated as far as the present neighborhood of Kansas. This was years before Plymouth Rock and Jamestown, and through the friars, who afterwards established chains of missions, civilization was established in what is now the rich and populous American West.

There is abundant confirmation of all that Coronado and his accompanying historians said about Hawikuh, which so closely resembles the present pueblo of Zuni. The treasure trove of science which the museum has been able to unearth through the generosity of one of its trustees, Mr. Harmon W. Hendricks, tells us truly

Like all primitive-minded folk, the Cibolans "killed," by breaking, the vessels buried with the dead, so that these might accompany their owners



A hunter, surrounded in his grave by deer's antlers, trophies of his prowess, and with the customary broken bowl at his head

all that the cities of Cibola were or hoped to be. Here are pots and bowls which still contain the remains of corn such as that from which were made the cakes, which the famished conquistadores said were "the best that ever they did eat."

The excavations have been for the most part along the slopes of refuse where the dead were buried. Some of the bodies had been cremated and placed in urns, alongside of which were the charred grains and foods made ready for the spirits of the dead. Here is a mighty hunter, a Nimrod of the Mesas, with whom were buried antlers of the deer that he had slain, in the hope that in the Happy Hunting Ground he might still have good sport.

The good friar was not wont to complain grievously of his dark guide, Estevanico, who exacted tribute of turquoises, and won the hearts of many native women, And here we have, driven tight to the skull of one of the feminine enchantresses of old, a comb of wood, encrusted with the blue gem and bearing a band of jet. The vanities which filled that once shapely head are no more, but here in the ruins of the venerable village, we have plenty of proof that the women of the day wore many adornments and were proud of their gaudy garbs. They were found surrounded by their jewels, such as they had, and the vessels of graceful form which they had with them in life. Many of the best examples of pottery were shattered as they were thrown into the graves—purposely sacrificed or "killed." There are some examples, almost prefect when exhumed, in which are holes in base and lid to show that they had been offerings to the manes of the dead.

Five hundred pottery vessels were dug up in the season just closed by the excavators of Hawikuh, as compared with the 350 which were found there by a previous expedition under the auspices of the American Bureau of Ethnology and the Museum of the American Indian. Specimens of basketry, matting, cloth, stones, cord, objects of wood, stone and bone, thousands in all, contribute to our knowledge of the ancient city and its ways.

It is believed that some of the remains are those of Indians who preceeded the people who lived there when Coronado came in quest of plunder. That is a matter over which the archaeologists may study for many a day to come by comparing and assembling the pottery fragments—a work now being conducted by F. W. Hodge, assisted by George H. Pepper, who spent last summer amid the excavations of the ruined pueblo.

There will be especial interest in interpreting the designs which appear on many of the objects. Especially promising are three bowls with the macaw, the goldfinch and the paw of a bear, with a pendant feather attached by a string. Another bowl bears the figure of a dancer.

When the entire collection is prepared for exhibition in relation to the surroundings of this present age, we shall find much which will appeal to all of us in the time-worn remains of New Granada, as Coronado was wont to call this first of the Seven Cities. They of Cibola lived in chambered and terraced dwellings four and five stories high, strongly built of stone and adobe, the original apartment houses of this country, the prototypes of those structures which we latter-day Americans inhabit. The Cibolans brought no boundless wealth to the conqueror, and yet in what a mighty city of riches and power have the bones of those who dwelt in that mysterious realm of old come to rest!

Water Tanks of Concrete Staves

THE accompanying illustrations show the construction of concrete stave tanks developed at Marfa, Texas. These tanks are used widely on the ranches of that vicinity. Until a little more than three years ago the concrete stave was not considered adaptable to the construction of large storage tanks, some of the leading silo builders having tried it out thoroughly and abandoned the idea.

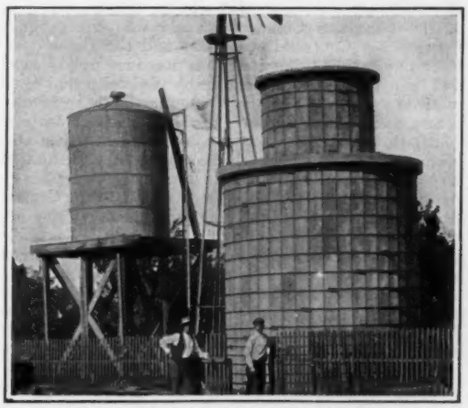
The drawing shows the details by means of which the concrete stave has been made a practicable device in this connection. The floor is criss-crossed with expansion joints, which are partly filled with tar or asphalt. It will be seen that the staves for the tank walls are of five patterns—long and short top staves, long and short bottom staves, and the full or regular stave. With proper combinations of these the wall can be carried to any unit height desired. In addition, there are special forms for the gutter

Jar containing cremated human remains, covered with a broken bowl

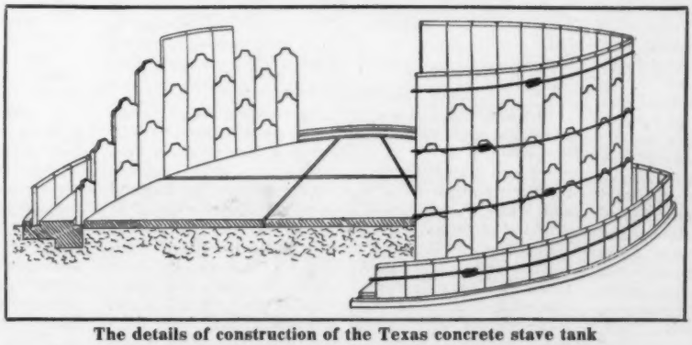
around the outer base of the tank; and the steel hoops with expansion joints provide the finishing touch.

The Current Supplement

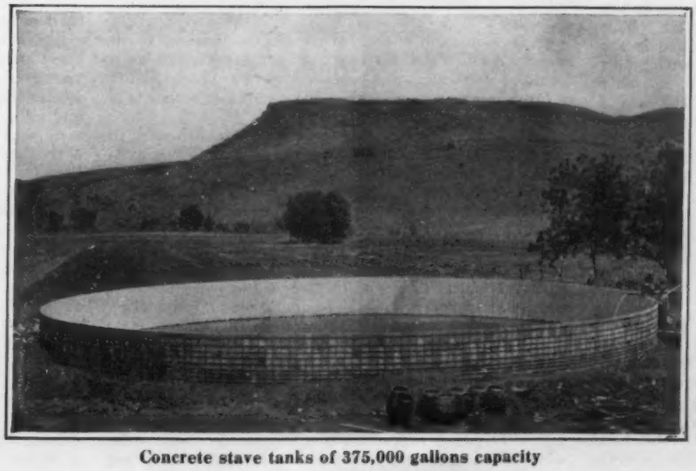
IT is fully recognized that the molecule plays a dominating part in every branch of physics, chemistry and many other departments of science. In a paper on *Molecular Orientations in Physics and Crystallography* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2245 for January 11, some of the problems relating to the molecule are reviewed from a new and interesting standpoint. A second instalment of the articles on *The Macoa Indians of Venezuela* appears in this issue, and it is copiously illustrated with original photographs. *The Pharmacology of Alcohol*, which treats of this important liquid in relation to its action as a drug will be of interest in these times of "dry" movements. *Steel for Reconstruction* calls attention to the enormous demands that will be made on the United States for this indispensable material, of which America is the largest producer in the world. The note is accompanied by a number of instructive photographs. *Curious Projectiles* describes a number of shells and bombs invented in Germany and Austria that appear to be more ingenious than practical. It is illustrated by a number of diagrams. *Airplane Accidents* is a careful discussion of an important subject from a medical point of view by a British surgeon, based on personal observations. Other articles of interest in this issue are *The Principles of Diffusion and Their Analogues; The Rat Pest; Sewage Disposal by Dilution; The Story of a Grass, A New Photographic Mordant Dye Process* and *The Theory of Fertilizers.*



A small tank of concrete staves



The details of construction of the Texas concrete stave tank



Concrete stave tanks of 375,000 gallons capacity

Making Old Iron Bridges Stronger

AN ingenious method of strengthening old cast iron bridges has been devised by a British major, the county surveyor of Shropshire. The fundamental idea is to encase the original arch ribs in ferro-concrete, thus making good defects resulting from cracks and general deterioration and rendering the structures capable of complying with modern traffic requirements.

The first bridge treated in this manner was a cast iron structure built 95 years ago by Thomas Telford when county surveyor of Shropshire. This bridge, situated on the main road between Shrewsbury and Ludlow, had long been unfit for heavy traffic, and in the course of a careful examination made last year it was found that two of the cast iron ribs had developed cracks of serious character at the haunches. On the recommendation of the major, the county authorities decided that the two defective ribs should be encased in ferro-concrete, and the work was successfully carried out on the Mouchel-Hennebique system. No disturbance of the road surface or handrailing was involved, the ferro-concrete work being executed from platforms suspended below the two outer cast iron ribs. The appearance of this historic structure has undergone no appreciable change, and the bridge is now very much stronger than at the time of its erection.

The county surveyor has arranged to strengthen in a similar manner a second cast iron bridge, built by Telford exactly a hundred years ago, on the main road between Shrewsbury and Wenlock.

British Steam-Power Economies

FOUR HUNDRED experts have been appointed by the coal controller of Great Britain to consult with and advise steam-power users how to eliminate waste. As the result of an inquiry by the Coal Control Technical Department it is clear that tremendous wastage of coal is going on which could be prevented. It will, however, take several years to recover the whole of this loss, even if a supreme effort is made by all the industrial firms, as it was impossible to install more efficient plant while the war was on. Another cause of wastage of coal is the employment of unskilled stokers, and, unfortunately, there are today perhaps more men of this description than at any other time, as so many skilled stokers have joined the army.

There are 45,000 users of steam plant in Great Britain. Up to the present reports on 364 firms have been carefully scrutinized, and it is estimated that a saving of approximately 106,000 tons will result. This saving can be effected without any serious alteration to plant in the following directions:

1. Obtaining greater efficiency in the combustion of fuel. 2. Educating of stokers. 3. Utilizing the heat in the gases to better advantage. 4. Using exhaust steam for heating feed water. 5. Adjusting engines more efficiently to use the steam generated. 6. Using the hot water from the condenser discharge for boiler-feed purposes instead of cold water. 7. Effecting lagging of steam pipes. 8. Disconnecting steam pipes not in use, etc.

Wartime Agriculture in Great Britain

The Administrative Machinery and the Means Adopted to Secure Land for Tilling

By Major H. Bannerman-Phillips

THE question of the food supply of the United Kingdom in view of the possibility of war with a nation possessing great naval resources had, of course, been considered before the war, and the advisibility of national granaries discussed, but nothing was done about the latter, and no measures were taken in peace-time to encourage agriculture. It was realized that supplies of meat and wheat from abroad would have to be depended on for a very large proportion of the food of the people, and though the average margin of reserves within the country was only sufficient for from six weeks to three months consumption, there was justified confidence in the ability of the Navy to protect the seaborne traffic of the British Empire. But when Turkey entered the war and Russian wheat could no longer be reckoned on, when harvests all over the world gave a reduced yield, when tonnage was increasingly required for other things besides food, when the submarine menace became serious, it was realized by the Government that the supply of meat and wheat from neutral countries would have to be more and more supplemented by home-grown supplies.

Putting the Farmer on a Firmer Footing

The poor harvest of 1916, with the low condition to which stocks of cereals had fallen, made it evident that the problem of the food supply of the United Kingdom would become acute in 1917. Other factors also seriously affected the situation. In 1915, partly in response to direct appeal, there had been an increase of 430,000 acres in the area of wheat and 280,000 acres in oats, though this was to a large extent offset by a decrease of 350,000 acres in barley and 75,000 acres in other cereal crops; there had also been a slight increase in the area of potatoes. In 1916, on the other hand, the area of wheat had fallen back by about 280,000 acres, while the yield of the crop had been considerably below the average; and, owing to the increasing shortage of labor, the outlook for 1917 was serious. It was estimated at the close of 1916 that the area sown with winter wheat, was 15 per cent less than in the preceding year. Further, the potato crop for 1916 had proved to be one of the worst on record, and the shortage in this very important article of food was already making itself felt. The Cabinet, therefore, decided immediately that vigorous action must be taken to secure, if possible, an increased area under cereals and potatoes in 1917, and to provide for a program in 1918 which would make the nation to a greater degree self-supporting in respect of cereal foodstuffs, of which normally 60 per cent is imported.

In dealing with the situation, the first essential was to strengthen and confirm the confidence of the farmer. The experience of the agricultural depression in the eighties and nineties, which had led to the heavy decline in the tillage area, made farmers hesitate to undertake the breaking up of land. There was on the one hand the growing scarcity of labor and the rise in costs of production, and on the other hand there was the natural fear that sooner or later cereal prices might come tumbling. It was therefore necessary, if a considerable tillage area was to be secured in 1917 and in the subsequent years, to give the farmers artificial security. With this object in view the Cabinet, in December, 1916, decided that prices for wheat, oats and potatoes in 1917 should be guaranteed to the farmer, the same guarantees applying to all parts of the United Kingdom. This program was subsequently more fully developed in the Corn Production Bill, with a view to laying down a policy which would make the country more secure, not only in 1918, but in the succeeding years. As in the case of munitions, so in the case of food it was felt necessary to ensure against the risks of a prolonged war. This act, by securing to the farmer minimum prices for wheat and oats for a period of five years, by providing a minimum wage for the agricultural laborer, and by securing powers of entry upon land and requirement of better cultivation where this was found to be desirable in the national interest, laid the foundations of the new policy and program.

The Machinery of Agricultural Expansion

The principles of this policy having been announced, the Board of Agriculture for England and Wales, the Board of Agriculture for Scotland and the Irish Department of Agriculture and Technical Instruction set to work to reorganize and extend the machinery for assisting farmers in the task of carrying out the program of increased tillage. It was necessary to develop both local and central machinery, but with the extended program it became more important than ever to provide for greater decentralization.

Accordingly one of the first steps taken was to set up in every county in Great Britain small War Agricultural Executive Committees of not more than seven members appointed by the War Agricultural Committee of the County, together with such additional members as the Board of Agriculture might appoint. In Ireland the existing statutory County Council Committees on Agriculture were available for the campaign. With certain reservations the exercise of the special war powers entrusted to the Board of Agriculture was conferred on these Executive Committees in their respective areas. These Committees have appointed special Sub-Committees to deal with certain branches of their work, such as labor, machinery, supplies and finance. In addition, in each district of the county, a District Committee has been established to act as an advisory body to the Executive Committee, and in many counties parish representatives have been appointed to keep the Executive Committees in touch with each parish in the county. The Central Department has appointed District Commissioners in charge of two or more counties who are *ex officio* members of the Executive Committees, and who act as links between the Central Department and the Committee. Each Executive Committee has its own proper staff and in many counties considerable assistance has been received from the County Councils, who have placed their officers at the disposal of the Executive Committees; while, throughout the country, valuable help has also been received from the staff of the Land Valuation Department and the Inland Revenue. The County Agricultural Executive Committees report to the Central Department on the state and progress of cultivation in their counties and frame estimates as to the possible areas of increased cultivation. They are also charged with the work of preparing estimates of requirements of labor, machinery, fertilizers, seeds, etc., and the successful carrying out of the extended program is in great measure due to the voluntary and hearty coöperation given by members of these committees.

At the same time steps were taken to increase the machinery of the Central Departments in order to deal with the new situation. The President of the Board of Agriculture for England and Wales appointed an Advisory Committee on Food Production and a special Food Production Department was established in January, 1917; in Scotland and also in Ireland special Advisory Committees to the Central Departments were appointed.

Getting the Land

The first problem was to form an estimate as to the additional area which could be brought under tillage in the spring of 1917. A rapid survey was made in February and March for this purpose, and on the basis of the reports rendered it was estimated that in England and Wales an additional area of 300,000 acres, and in Scotland of 50,000 acres, might be secured. Under the Defence of the Realm Regulations the Boards of Agriculture for England and Wales and for Scotland had been given powers to enforce cultivation where they considered that the land was not being properly tilled, and these powers, with certain exceptions, have been delegated to the County Agricultural Executive Committees. Acting under these orders, the Committees can serve notices on occupiers requiring them to cultivate their land in such a manner as the Committees think necessary or, where no improvement takes place as a result of warning, the Committee may take possession of the whole or a part of the farm and either cultivate it or let it to new tenants.

The Committees report their proceedings each week to the Department, and the picture they give of the agricultural conditions of their counties shows that large parts of rural England had sunk into a veritable slough of despond. Case after case was reported of considerable areas of land which, having at one time produced good crops, were either entirely given up to sport, allowed to become derelict or farmed in the most careless and negligent manner. Many of the worst cases are those of occupying owners who do not depend on the production of the land for their livelihood, and for whom there is no excuse on the ground of lack of the necessary capital. In other cases, however, farmers had been allowed to obtain possession of far more land than they were able to cultivate adequately with the capital at their disposal, and in some parts of the country there are large areas which formerly supported a considerable population, where the houses and buildings had been allowed to fall into ruin and the land had been used merely as extensive sheep or cattle ranges. Wherever possible such places are being dealt with by the Committees, but many of them will require new buildings and other works on a scale impracticable during the war.

All powers resident in the Committees have been exercised; but in the main the increase in tillage in England and Wales and in Scotland has been obtained by voluntary appeal to farmers. In the case of the 1918 program, however, which provides for an increase in the arable area over 1916 of 2,700,000 acres in England and Wales and 350,000 acres in Scotland, the Boards of Agriculture have allocated a quota of this amount to each County Agricultural Executive Committee, which is empowered to serve notices upon farmers in its area calling upon them to provide a certain amount of additional tillage. The Committees have been engaged in carrying out a detailed survey, in order to apportion their quota among different farms, to schedule grass land which might with advantage be plowed up, to secure an increased area of cereals, roots and potatoes on the existing arable land, and to ascertain any land which is not being cultivated by the present occupiers.

In Ireland a different procedure was adopted. The Department of Agriculture and Technical Instruction, by an Order in Council of January, 1917, required all agricultural holders of over 10 acres to increase their arable area in 1917 by 10 per cent, except where the arable area on any farm already amounted to 50 per cent of the total area suitable for arable cultivation. With regard to 1918 it is proposed that the additional area to be tilled shall be an increase of 15 per cent on the 1916 area, with a further five per cent increase in the case of farms having 200 acres or more of arable land.

New Agriculture on Old Lands

Steps were also taken to survey areas of land where production could be improved by drainage. In almost every county there are thousands of acres which might be used for agricultural production if properly drained, and in England and Wales nearly 100,000 acres have been inspected and reported on, and several schemes have been put in operation which would secure an immediate improvement in the land for tillage purposes. In Scotland also a survey was made of deer forests with a view to restocking tracts of land with sheep.

A great live-stock industry has been built up on the wonderful permanent grass lands of England, but the enforced extension of the corn-growing area by the usual method of plowing up the land has already encroached on the turf, and threatens still further inroads. It is now believed to be possible to use the grass lands for growing oats and wheat and still keep them for grazing and for raising hay. A method with this object has been devised by an English farmer and tried by him with success on a small scale during the past year. It was described in the SCIENTIFIC AMERICAN for June 29th. If the plan is adopted on a large scale this year, as is now proposed, it will mean more grazing this year, more beef next winter, and more oats, wheat, hay, and grazing in 1919. If the new method is as successful over a large acreage as it has proved to be in the experimental stage it may rightly be termed a great discovery in agriculture, peculiarly valuable to England, where the gain in grain crop through plowing up the turf hardly compensates for the loss of grass, even in these times of grain deficiency.

Apart from increasing production on agricultural land, important developments have taken place in providing land for allotments. Under the Defence of the Realm Regulations powers have been delegated to Town and Urban District Councils enabling them to take possession of any unoccupied land and, with the sanction of the Agricultural Executive Committees, of any occupied land for the purpose of letting it as allottments to the residents in urban areas, who can cultivate it in their spare time. Complete statistics of allotments are not available, but in England and Wales alone, up to 31st December, 1917, reports from 1,095 urban districts show that 185,147 plots have been provided; in Scotland there are returns of close on 20,000, and in Ireland of 12,000 allotments. But these statistics do not include the rural districts and by no means include all allotments in urban districts. A complete register is being taken in hand. The tenure of plots has been extended until the 1st of January, 1919, and the enthusiasm displayed in the movement, and the taste for gardening which it has fostered in the urban population, make it certain that further measures will have to be taken to meet the increasing demand for allotment land.

Old Names for a New Navy

The Heroic Associations That Attach to the Names of the Famous Fighters of the Past

SECRETARY DANIELS has issued no order so completely popular as his ruling that our five new battle-cruisers shall be designated the "Constitution," "Constellation," "Saratoga," "Lexington," and "Ranger" The Chief of the Navy Department has brought back to our first fighting line traditions as splendid as they are old.

When milady Juliet figured it out that there was, after all, nothing in a name, she was taking count of no more than a family feud which promised to make the course of true love just a little rougher than usual. She overlooked the detail of naming ships. There lies all the difference between inspiration and nausea. Think of putting to sea aboard the "Apronstring!" The psychology of a single word would demoralize the best crew that ever signed up. To sail on the "Mauve" would be a colorless transaction. But to face the foes of one's country from the deck of a "Constitution" or a "Niagara" is to set yet keener edge to the characteristic American fighting qualities. What fine patriotism would be bred from mere service on a craft called "Constellation," with all her daring memories of achievement!

The original vessel of that name, now at Newport as a training ship, will hereafter be the "Old Constellation," even as it will hereafter be the "Old Constitution," which visitors at Boston's Navy Yard will visit and honor. There is no "Lexington" at present on the list, though the mighty cruiser now planned will be the fourth to bear the name. The "Saratoga," existing till 1911 as the cruiser "New York," when she took part in the battle off Santiago de Cuba, will now be rechristened once more and become the "Rochester."

In the name of a nation's naval line one may read the nation's spirit. National feelings and ideals are there typically set forth. Our own method, for instance, though at first sight lacking in originality and rather prosaically methodical, keeps well to the fore the basic thought of our Federal structure. If the battle-cruisers are hereafter to be named to commemorate the mighty historic past of which we are justly proud, the dreadnoughts will continue to bear the names of our states, and each sovereign commonwealth undoubtedly has as sound a right to a battleship all its own as to its own star in the blue field of the flag. Our cruisers are christened in honor of our greatest cities; our gunboats for those of lesser size, albeit often of historic eloquence (as "Yorktown" and "Chattanooga"), while it is reserved for the destroyers to recall distinguished names of naval commanders past and gone though not forgotten.

During the war we have had illustrated three interesting instances of this last-mentioned method, in the christening of the "Radford," "Montgomery" and "Kilty." Few non-naval men of today recall this trio of Rear Admirals, unless it be their fellow-townsmen of Fincastle, Virginia, Allentown, New Jersey, and Hagerstown, Maryland; yet they were gallant commanders all. Radford was in charge of a cutting-out expedition during the Mexican War, was captain of the "Cumberland" when she was sunk by the Confederate ram "Merrimac," and directed the "New Ironsides" during the attacks on Fort Fisher in the Christmas week of '64 and fortnight following. Montgomery's 54 years under the starred jack (he was appointed midshipman in 1812), brought him service on Perry's "Niagara," under Decatur against the Tripoli pirates, and throughout the struggle between North and South. Kilty was both active and successful in the water fighting of that same Civil War, first under Foote in the Western Flotilla and afterwards on the White River.

In this same destroyer connection, it is distinctly worth the record that, for the first time in our history, one of this class of vessels has been named for an enlisted man—and in thus honoring Chief Gunner's Mate Ingram, of the U. S. S. "Cassin," Mr. Daniels has at once done a graceful thing and commemorated an heroic action. When the "Cassin" was torpedoed she, like other destroyers, had depth bombs stowed on deck aft. These were charged with a considerable weight of high explosive and, as the case of the "Manly" has since shown, their detonation would do a deal of damage. Ingram saw the silvery wake of the Hun torpedo as it sped toward the "Cassin," and saw also that it would strike her aft. Though he must have known that the chances against him were tremendous, he took no thought of himself, but ran aft and succeeded in getting the depth charges overboard just before the torpedo struck, killing him before he could get forward. But, due to his self-sacrifice, the "Cassin" was saved from worse damage and he was the only victim of the torpedo. Courage is a commonplace in the fighting services, but such a deed as Ingram's maintains the best traditions of the Navy.

The great sea-fighters of Europe indicate clearly the characteristics and history of the several lands to which they belong. England has recorded in steel the magic names "King Alfred" and "Queen Elizabeth," "Marlboro" and "Lord Nelson," "Cornwallis" and "Drake." The "Agincourt" has already entered the battle line, glowing with the traditions of that signal victory of the fifth Henry. Around the "Temeraire" brightly shine recollections of Trafalgar, while the "Ramilles," "Iron Duke" and "Black Prince" all speak with prophetic comfort to a militant today through English triumphs of long ago.

The academic shades of Oxford and Cambridge are recalled, too, by John Bull's "classic" craft the "Ajax," "Neptune," "Jupiter," "Mars," "Theseus," "Minerva," "Diana," "Juno," "Adriadne" and pretty much all the rest of Parnassus. When the guns of the "Agamemnon" spoke deeply off the Dardanelles they not only recalled the siege of Troy, distant 3,000 years if only a few score miles, but, also, seemed to echo the thunders of its forefather's cannon at Copenhagen. So again if the "Bellerophon" awakens memories of winged Pegasus, much more does it recall the day when the great-great-grandpapa of this modern marine Cerberus received, in durance vile, that mighty and superlatively dangerous

(Continued on page 40)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Shipping Problem

To the Editor of the SCIENTIFIC AMERICAN:

I agree with your editorial this week on navy expansion, but did it occur to you what folly it is also to squander money in merchant ship expansion on the proposed plan of Mr. Schwab, at present excessive costs. The building of ships during the war at exorbitant costs, and perhaps even of ships that can be useful immediately, can be excused; but would any sensible man consider it expedient to continue building ships, at such cost that these ships will be handicapped all their life. The ship plan proposes to build ships at four times normal cost. They have wasted millions in building obsolete wooden 3,000-ton, 10-knot boats costing $600,000 each, which can not earn their expenses in competition with up-to-date modern vessels of 6,000 to 10,000 tons of steel. Before the war, a 3,000-ton steel boat cost $125,000 to $150,000. Two years from now, you will probably be able to build with $600,000 a 6,000- to 8,000-ton boat. The plan will land the United States with a fleet of high-priced vessels that can not compete. Our officials seem to think ships are the same as railroads. The difference is, that the ship offering the lowest freight rate gets the business, but a railroad is a monopoly. If I originate 100,000 tons of cargo on a railroad, I must ship over that road, but if I have that much cargo at a port, the cable brings every ship owner, competing for it in normal times.

Can our Government run these ships as cheaply as Norway, Italy, Japan, Germany, Great Britain? I believe not. We, as private owners, could not, and certainly Government management is more expensive than private ownership. Must the tax payer pay the losses for years to come, or will our ships rust at our docks, because our costs and expenses are too high. Rusting ships, that can not compete, tied up to the dock, have been common, even good ships. Will business expand and keep up freights? I believe freights must decline and will to 20 per cent of present rates. High freights prevent business growth and expansion. A company of which I am a Director had two 3,000-ton Scotch-built steel steamers, which cost us $150,000 each; We sold them for over $500,000 each. No private owner can afford to face United States competition; unless war profits have paid for his ships. Mr. Schwab's interests are steel; he builds ships at United States cost. You and I pay the bill. Steel gets the business and profits now; the running of the ships at a loss later is another question.

H. I. UNDERHILL.

"A Broken Idol"

To the Editor of the SCIENTIFIC AMERICAN:

I have just read and reread your editorial in the issue of November 23d under the above title, trying hard to get at the root of what you mean. There is no single statement in what you say that I would oppose, but there are underlying implications that will be used to thwart the great cause of the League of Nations, whether you intended it or not.

No man can be a good "citizen of the world" who does not thrill with pride for his own country. But no man is an *intelligent* patriot, no matter how great the sacrifice his devotion has led him to make for his country, who does not work for the establishment of an international system of justice that will be less haphazard than the benevolent anarchy (from our standpoint and that of our Allies), that has been proven so insufficient.

The creation of the League of Nations is the supreme task of our generation. We can not solve in advance all the great problems of the future, but the organization of the machinery of international control is our sacred duty, the neglect of which would make us slackers to posterity.

The time is ripe, and every publication, scientific and otherwise, should rejoice to use its space to arouse men to this great moral and spiritual mobilization.

L. O. MCAFEE.

Ismay, Mont.

The Oil-Cooled Kerosene Engine

To the Editor of the SCIENTIFIC AMERICAN:

I cannot resist the impulse to express my appreciation of your article on "Oil-cooled Kerosene Engine," that appeared in the November 16th SCIENTIFIC AMERICAN. Your authoritative statement of the facts in this case is the most welcome of anything that I have read for quite a time. Incidentally, may I add that for several years past I have been giving quite a bit of time to the study of such a development and including no small amount of simple physical experiments. Might mention that in this same issue of the SCIENTIFIC AMERICAN I was favored with a brief mention of a patent on temperature control means.

As unnatural as it may sound to you, it has been my experience to learn that even many well-known automotive engineers, although devoting valuable talent to the perfection of the industry, are apparently uninformed or not open to conviction as to the undeniable possibility of the great increase in fuel efficiency that is inevitable with the adoption of internal combustion engines designed to operate at higher temperatures. In fact, statements that I have received in reply to my inquiry as to their attitude along this line are so elementary and unappreciative as to become absolutely disgusting. It is my fervent prayer that more engineers of your kind shall eventually see fit to impress this fact upon the minds of the masters of the engine world. I am sure that the result would be that the near future will see an evolution that will surpass any of the truly marvelous innovations that have done so much in the past.

I trust that this simple note of appreciation will at least tend to soothe any effect of averse criticism that your article may have brought upon your head.

Anderson, Ind. HARRIS S. COY.

The Electron Formula

To the Editor of the SCIENTIFIC AMERICAN:

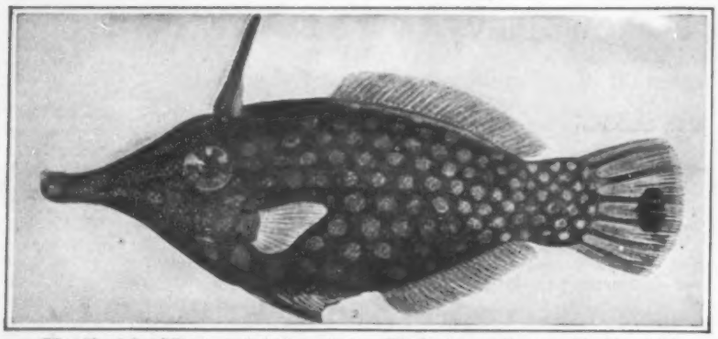
With reference to the electron theory of the physical and mechanical universe I would like to recall to the readers of the SCIENTIFIC AMERICAN the fact that the Alfred Nobel $40,000 physics prize awaits the discoverer of the electron formula.

In 1906 Sir J. J. Thomson of Cambridge University, England, was awarded the Alfred Nobel $40,000 physics prize for advancing the electron theory and it has been suggested that a scientific society be organized to devote its entire time researching for the electron formula.

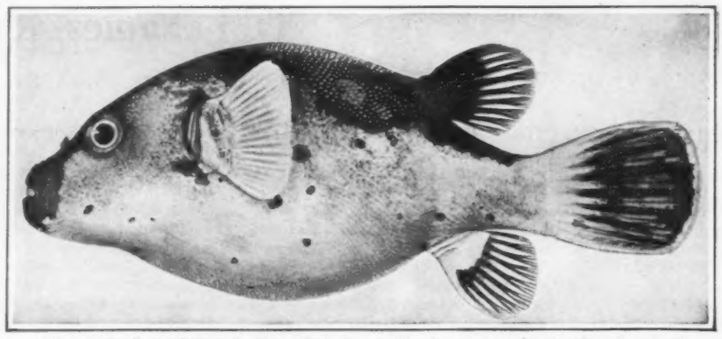
The writer would be pleased to hear from those who believe in the electron theory when we may eventually reveal the great law of the universe through the columns of the SCIENTIFIC AMERICAN:

ERA M. V. LEEWAH.

New York, N. Y.



The file fish of Eastern Asiatic waters. His bottom spikes enable him fairly to sit down on his victim as he stings



The tetraodon of East India. Bristling with short strong spines and armed with strong teeth, natives call him "deadly death"

Weeding Out the Poisonous Fishes

How Scientists Are Tying a Figurative Bell on the Dangerous Denizens of the Deep

MR. E. W. GUDGER, Professor of Biology of the North Carolina State Normal School, in behalf of the Carnegie Institution, Washington, has been engaged at the American Museum of Natural History, New York, studying poisonous fishes. In Washington, a section of the Bureau of Fisheries, under Dr. Hugh M. Smith, Director, is busy on similar lines. In California, Dr. David Starr Jordan, President of Stanford University, is strenuously at work testing all kinds of fishes available. There is a universal and feverish effort going on in different institutions to test up all products of the salt and fresh waters of the world, to get at everything edible and throw into the discard everything unfit for human food. As to the latter, every effort is being made to find some kind of utility for discarded species, either for leather, fertilizer, commercial or medicinal oils, etc.

Poisonous fishes, for convenience, may be divided into those forms which are unsafe to eat, and the types which by their bites are destructive to edible or useful fishes and dangerous to man. There are also side lines of conditions which are unsafe. For instance, the bluefish, the most popular marine food in summer, will if it happens to feed upon decayed mossbunker used as chum by commercial fishermen or anglers, not only make ill those who eat it, but cause the face and other parts of the human body to break out in a conspicuous rash. The carnivorous bluefish in the ocean, which feeds ravenously on schools of mossbunkers which it follows, is perfectly edible when taken by net fishermen. When, however, the mossbunkers enter the bays to breed they stick to shallow water where they are safe from pursuit. It is then that the bait boats offer iced mossbunkers (or menhaden, or oilfish as they are called) for the use of commercial fishermen and thousands of pleasure anglers. The iced mossbunker soon decays in the heat and the bluefish that fill up with him become permeated with alkaloids which they convey to the stomachs of humans. It depends upon the human stomach involved, whether there is immunity or not from fish alkaloids and ptomaines.

Still another source of danger to humans is the fish that have died which are sold in the markets or caught with a hook. In Europe, net fishermen or anglers who allow fish to die in the air, are prosecuted and punished to the extreme limit. All fish caught in European waters must be butchered alive. Even the hook angler, catching fish for his own home consumption, must kill each fish with a knife immediately upon taking it from the water. Government inspectors go out with fishing fleets. They require that fish must be butchered alive, the same as steers, and the carcasses thrown into iced holds. Only iced or frozen fish can be sold in the markets or peddled. In America, few such precautions are taken, and hence the vast amounts of decayed and unfit fish consumed, bearing toxic alkaloids to the human stomach. Hence also, the vast amounts of fish condemned by boards of health as unfit for consumption. When an angler, for instance, kills his fish with a knife as fast as caught, he can put them in his bag or box with perfect safety. A butchered fish, if left in air or sun, will be protected for hours by its own skin and be perfectly safe eating for some time.

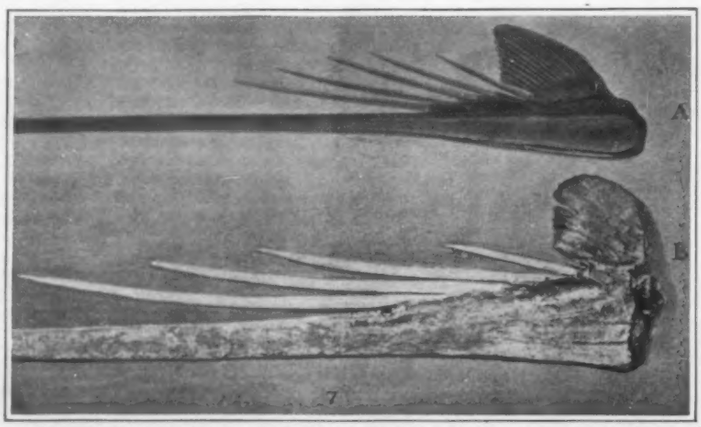
The other form, the fish that exude poison or posionous bacteria fatal or detrimental to humans and edible fish, also most deeply concern the laboratories. It seems vital that all such forms should be tagged and placed upon the card index for universal destruction as a commercial necessity. It is feared that such forms both will be eaten if left in the waters and will continue to destroy edible marine products in enormous quantities. Dr. John H. Nichols has recently cautioned the public against the well-known blowfish. He warns that it is poisonous to humans. Strange as it may seem, the blowfish which was formerly regarded as a pest by anglers, has for several years become popular for the frying pan. Upon its back are two strips of "tenderloin." Not only have anglers of late been greedily stripping these off, but the numerous fishermen's small hotels along the coast have been serving the tenderloins as a delicacy. Yet this fish is poisonous and should not be eaten, except by people whose stomachs are as immune as a goat's or ostrich's. Dr. Gudger also warns against eating the barracuda as a fish causing ptomaines in humans from toxic bacteria.

Pteroise volitans, a large and much feared stinging fish of Samoa

Some of the most poisonous fish of the world are found in the waters of Samoa, Hawaii and the East Indies generally, although for that matter, equatorial waters everywhere have their peculiar forms. Of these the family Tetraodon tidae is most conspicuous. It is difficult to understand why these fellows, heavily armored as they are with stout spines, stout jaws and teeth, should also need to exude posion for their protection from enemies. Jordan and Searle describe the several species: "The group are more abundant in the East Indies than the South Seas. They are regarded as poisonous, although none of the species has the bad repute possessed at Hawaii by *Tetraodon hispidus*. The natives call them *sui*, meaning puffers, or blowfish. *Hispidus* is very abundant in the lagoons and mullet ponds. It is regarded as excessively poisonous, *mukimuki*, or deadly death, being its local name. Nigropunctatus is very common about Apia and Pago Pago, and is likewise regarded as poisonous. In some instances the body is covered with bristles so long as to give the appearance of coarse fur. The highly colored family *Lutianus*, mostly with red shades, has poisonous species, of which monostigma is a conspicuous example. It is common at Apia with a coppery red coloration, and has no teeth on its tongue. Another large, brick-red species of the family, bohar, with large canine teeth, is poisonous. It ranges widely in the East Indies.

"*Pteroise volitans* is a large stinging fish of Samoa, Tahiti, New Guinea, New Britain and the East Indies. It is blackish red in color. The natives call it *Sausaulele*, because of its fluttering, butterfly flight in water." It will be noted that this fish somewhat resembles the Atlantic sea robin in appearance. There are, however, tentacles on the head and it is armed with knife-like spines, and is capable of stinging in all directions whatever it comes in contact with. The stings of some fish are as deadly as their bites. This fish also has bands of minute teeth to sting with.

Of the deadly sting rays of the Eastern Indian waters, Jordan and Seale name a new one, *Himantura fai*. The Tahitins call it *fai*, the New Zelanders *whai* and the Figians *vai*. Sting rays are everywhere deadly, on our own coasts as well as elsewhere in the expanse of salt water. Many prominent fishermen have been killed by their stings. They are difficult for laymen to distinguish from ordinary skates, which fact should make all persons cautious in handling these triangular flatfish. The rays have long whip-lash tails. In the sting ray, there are on the tail, below the body, two protruding spines, or stingers, which the animal is very deft in thrusting into his annoyers by squirms, whether in water, in boat or on shore. The sting may or may not be deadly, according to quick treatment of the wound and the condition of health of the victim. The sting fluid, or fish slime invested with toxic bacteria, quickly circulates with the blood, permeating the whole system. Many people have been killed by the sting, and the life of Capt. John Smith is alleged to have been saved by Princess Pocahontas only after eight months of careful treatment and nursing following a thrust by a sting ray.



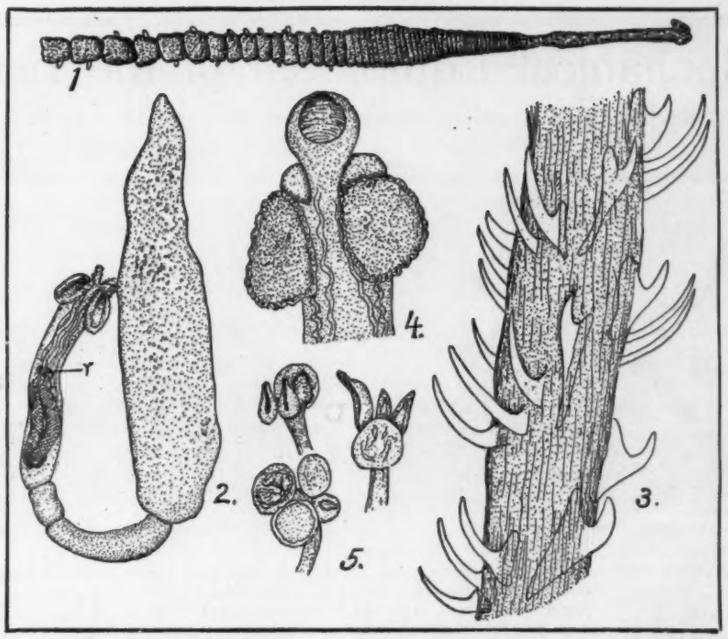
Poison-bearing spikes of the giant rayfish, which inflict a dangerous wound

Two terrors of the Eastern seas comprise fishes with poisonous spines. They dart out from under rocks and from the depths of pools and thrust their virus into disturbers of their peace, whether natives or denizens of water. They have a wide range of habitat. They rejoice in the names of *Sebastopsis guamensis* and *scabra*, and *Sebastapistes laotale*. They have poisonous spines on the head, one directed forward and the other backward; spines on the cheeks and nostrils and 11 spines

elsewhere about the fins and body. One species has a deadly spine at the base of the under part of the body, so that he can fairly sit down on a victim and sting him. Two other spinous species are even more interesting. *Amanses scopas*, a file-fish, has a sheaf of long needle-like spines, about ten in number and nearly as long as its head, on each side near the tail. These spines are thrust into enemies approaching it behind. Forward, it is protected by the sharp teeth in its long snout, a heavy spine on top of the head and a short, stout spine on the center of the belly. Even more dangerous is the trunk-shaped file-fish *Monacanthus*. The triangular spine on the back of its head is armed with spikes. Below is a heavy, movable spine with an armature or battery of heavy spikes. The snout is equipped with knife-like teeth. The dorsal spined fish of uncomely form most dreaded by the natives is called *nofu* by them. Its name is *Syanceia* and it abounds in the tide pools and about the coral reefs. The deadly poisonous spines being on the back fin, make it exceedingly dangerous to handle.

From the other side of the world, Africa, comes *Protopterus* to the American Museum. Herbert Lang, the African explorer says of it: "At Nouvelle Anvers the natives are very much afraid of being bitten by the live *Protopteri* which they bring to the market in pots of water. When one is thrown on the ground it is very active, wriggling like a snake and moves along in a like manner. These fish live in the dry sand when the bottoms of the rivers are on top, as

(Continued on page 40)



(1) parent cestode; (2) the deadly pigment of the cestode, below the head at *r*; (3) proboscis of the cestode, enlarged from a diameter of .9 millimeter; (4) larval cestode; (5) three enlarged views of the cestode's head.

Poisonous parasite (enlarged) which the sting-ray injects into the wounds it creates

Changes in Iron After Repeated Heating

AT a recent discussion before a large British technical society of certain changes in cast iron after repeated heating, a prominent metallurgist called attention to the effect of repeated cooling in water on same large steel tongs which became red hot each time they were used.

The result of this continued heating and cooling was to cause a very material contraction in the length. The envelope contracted when being cooled, while the portions below were more plastic then the chilled outer layers. The effect was that the more plastic central portion was forced or "jumped" down, causing contraction in length and bulging of the sides. There was probably no decrease in the actual volume, but only a change in the position of the steel. Incidentally it might be remarked that the result obtained suggested the somewhat startling hypothesis that if an oblong bar of soft steel were to be heated and cooled a sufficient number of times under proper conditions it would eventually assume a globular shape.

An almost perfect instance of the effect here so well predicted was cited by another metallurgist at the same meeting. In order to warm a small tank of water used for molding purposes at the workshop of Robert Rogers & Co., Stockton, England, a piece of iron, weighing several pounds is heated over a coke brazing-fire to a blood-red heat, then quenched until it is nearly cold. Some years ago a cylindrical piece of soft steel, similar in shape to that shown in the illustration was cut from a round bar of about 3.5 inches diameter and used solely for this purpose. The analysis of the steel was as follows: Carbon, 0.05 per cent; silicon, 0.01 per cent; phosphorus, 0.08 per cent; sulphur, 0.05 per cent; manganese, 0.45 per cent.

About 200 heatings and quenchings were given in a year, and in the course of four years of this treatment the cylindrical piece had gradually become nearly spherical in shape, as shown. An intermediate stage in the transformation is seen in the center figure of the illustration, which is a photograph of a similar piece after it has been subjected to about 200 quenchings.

The remarks, quoted above, are clearly illustrated by these examples, the pressure on the hotter internal metal due to the more rapid contraction of the chilled outer layers having ultimately caused the piece to assume the globular aspect shown in the third or second figure of this illustration. Measurements taken indicated that, after 800 quenchings, the cylinder had contracted in length about 0.75 inches and had also increased in width by a corresponding amount. Each quenching must therefore have caused a maximum displacement of material in a lateral direction of about 1/1000 of an inch.

After 800 heatings and quenchings, the block of steel shown at the left had developed the shape at the right, passing through the central stage

Pressure Marks on Photo Plates

By M. Luckiesh

SEVERAL years ago while scrutinizing some photo-spectrographs for fine detail, certain irregular markings were found which excited a suspicion that they might be made by ions present in the air owing to the particular conditions surrounding the work. Furthermore, owing to the fact that these tracks were found only on one type of panchromatic plates and not on any of a number of other types of plates which were used, it appeared that they were peculiar to this particular plate for some reason. Various experiments were conducted to ascertain the origin of the tracks, including the development of several dozen new plates which were unpacked in the darkroom and immediately developed without being subjected to any possible influence in the laboratory. The tracks were found on all these new plates of this type, which were obtained several years after those on which the tracks were first noticed, and further investigation did not reveal any on other types of new plates.

It is a fact of photography that a latent image can be impressed on a photographic plate by minute abrasions of the emulsion surface. These are known as pressure tracks. The particular type of plate under consideration appeared to be packed as well as others in the original package, having cardboard strips between plates. Nevertheless these pressure tracks appeared to be due to particles of gritty substance being rubbed against the emulsion, because similar tracks were reproduced in this manner by using fine particles of sand. The individual markings or "pressure marks" are too small to be troublesome in ordinary photography but are visible under careful observation to the naked eye. They can be very annoying in photo-microscopy.

The illustrations are high magnifications of the original "tracks" and are of some interest not only photographically but from the standpoint of the antics of a small particle rubbed between flat surfaces. Fig. 1 is the result of magnifying a nest of "tracks" about fifty times. The long trail appears to have been made by a single particle. This portion is seen at a higher magnification (about 125 times) in Fig. 2 although incidentally this photograph is reversed as if Fig. 1 were seen in a mirror. The more complicated region of Fig. 1 is seen enlarged (and reversed) in Fig. 3 to the same magnification as Fig. 2. The character of the darker or heavier spots is shown in Fig. 4 greatly magnified, although this photograph is of a different subject.

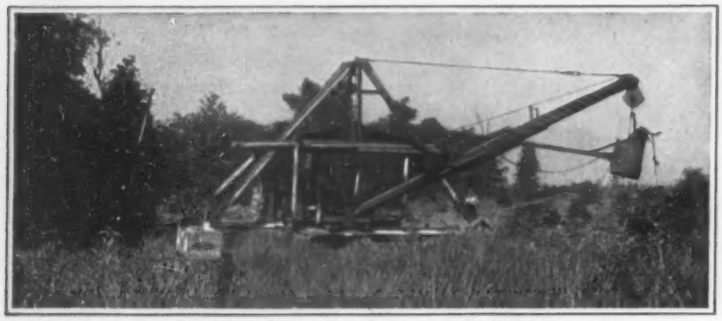
Fig. 1 Fig. 2 Fig. 3 Fig. 4

Pressure tracks on photographic plates, greatly magnified. For detailed information see the text

Mechanical Equipment of the Farm

Latest developments in agricultural machinery and practical suggestions for the farmer

Conducted by HARRY C. RAMSOWER, Professor of Agricultural Engineering, Ohio State University



Dredging the outlet of an open ditch drain

Machine for gathering corn and binding it into bundles

Cleaning and Deepening the Open Ditch

ONE of the phases of farm drainage which is too often neglected is the open ditch. For land drainage we rely upon underdrains almost exclusively, but all tile ultimately empty into the open ditch. The vital importance of this ditch comes from the fact that no underdrain can be better than its outlet permits it to be. More often than not this outlet ditch is filled with grass, weeds, and trash, to such an extent that the tile emptying into it are completely clogged at the outlet and are thus largely useless.

In large ditches serving as the outlet for a considerable area of underdrained land, the dredge is used to good advantage. If a large volume of water is present, a floating dredge is perhaps most convenient. In the greater number of cases, however, large ditches are needed—too large to be cleaned and deepened by the use of horse drawn scrapers, yet not large enough to take a floating dredge.

The dredge shown on this page might be called a dry land dredge. It is supported by heavy timbers on the banks of the ditch. A convenient track is laid over which it may be propelled. Its powerful hoist enables it to cut through trash, roots, etc., with comparative ease. Where the extent of the work justifies, it will always pay to use a machine of this kind rather than to rely on ordinary scrapers drawn by horses.

The One-Horse Gasoline Horse

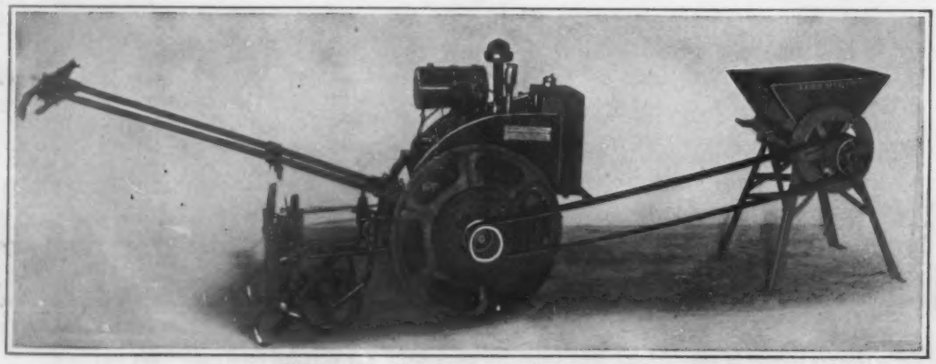
THE title may sound rather odd, yet no other term seems to convey the right meaning. The larger sized tractors are intended to do the work of two, four, six, eight, or more, horses and many times they are thought of in terms of the number of horses whose power they equal. But the one-horse tool is a necessity on most farms while in many instances, as on small farms devoted chiefly to truck gardening, it is used much more than any other tool. It remained, therefore, for someone to design a machine that would find favor where the one-horse job was the chief issue or where a considerable amount of hand labor might better be done in some more rapid and more profitable way.

The garden tractor shown on this page is the result of effort along this line. As the machine stands it is 72 inches long, 17 inches wide and 36 inches high. It is equipped with a single-cylinder motor, 3½ x 4½ bore and stroke, with a belt speed varying from 300 to 2,200. The total weight of the machine is 550 pounds.

It can readily be seen that this tractor is capable of doing only very light work. The plow which it is intended to pull, cuts a 7-inch furrow and the various tillage attachments are of corresponding size. It is easily handled in garden work. There is, in addition, a pulley attachment which can be used for light belt work. The diameter of the pulley is 4¾ inches and it runs at 800 revolutions per minute at normal engine speed.

A machine of this kind, honestly built, should fill a real place in our immense truck gardening business The individual who wishes a garden of something larger than average size can use it to good advantage. It might also be used to draw a large lawn mower where a considerable area must be cut regularly, but where the size would not justify a power mower. The chief difficulty which users of this type of machine will encounter is this—they will expect too much of it. Its limitations must be recognized. It really does not possess the power of one horse. While it is true that a horse at steady work cannot develop more than ¾ horse-power, yet in an emergency and for a short time he can multiply this effort many times. It is for this reason that those who have been accustomed to using horses are frequently disappointed when they undertake the use of motor power. This is not a criticism of motor power; the statement is made to forestall possible disappointment.

Plowing with a one-horse gasoline horse



The gasoline horse as a stationary engine

A Loading Attachment for a Cornbinder

IT has long been recognized by practical farmers that the handling of the corn crop is one of the hardest tasks of the entire year and one phase of farm work which, in spite of numerous labor saving machines, still calls for a large amount of hand labor. The various types of so-called sled cutters work very satisfactorily if the corn stands up well, but corn frequently becomes lodged and twisted so that these simple machines cannot be used at all.

The corn binder will gather and bind into bundles, even badly lodged corn, but it is not an easy task by any means to pick up and set the bundles in shocks. A number of attempts have been made to devise shocking arrangements for different forms of corn harvesters, but none of them have met with much success. It has always been found next to impossible to make a shock that would stand erect for any length of time. In the hands of a skilful operator, fairly good work can be done, but, in the main, shockers have never become widely used.

The attachment shown on this page has already been put to wide practical use and with considerable satisfaction from the mechanical point of view. That it is a remarkable labor saver there can be no doubt. It can be used, of course, only when the corn is put into a silo, but this means no small amount of hard work and hand labor saved annually, when the country as a whole is considered.

The photograph at the head of this column shows the machine in service, being hauled by a tractor. The tractor, by the way, is especially well adapted to drawing the corn binder. This tool is a heavy draft machine—more than a load for two horses, and it seems to be rather awkward and inconvenient to use more than two. Further, the machine works much better if drawn at a steady rate.

Cement Drain Tile

THE question as to the merits of cement drain tile, especially their desirability as compared to clay tile is continually being raised in the minds of farmers. This is a proper question and deserves consideration.

In the first place let it be said that there is no reason why first class drain tile should not be made from cement and good, clean sand or fine gravel. The materials should be mixed in a proportion not leaner than 1:3, that is, one part of cement to three parts of aggregate. The tiles after being molded must be carefully and completely cured if they are to attain to the proper strength. In the better commercial plants the tiles are steam cured. They are put into more or less air tight compartments and the atmosphere within is kept saturated by means of steam pipes in water.

The fact remains, however, that many of the cement tile that have been made in recent years have not been of good quality. This may have been due to any one of a number of causes such as

(Continued on page 42)

The Continuous Nitration of Hydrocarbides

THE nitration of hydrocarbides, of gylcerine and of cellulose, which is the preliminary step in the manufacture of powders and other explosives, was nearly always a discontinuous operation before the war. This discontinuity was practiced in order to avoid the danger arising from the high temperatures produced when large masses are treated; by operating discontinuously on comparatively small quantities cooling is facilitated and danger in the case of explosion is limited.

But the enormous quantity of explosive material expended in the present war and the scarcity of man power have caused inventors to seek processes permitting continuous nitration, at least in the case of liquids, of large quantities by means of apparatus to insure prompt and permanent cooling.

One method employed for cooling was agitation with paddles; this was abandoned, however, because of a serious explosion which took place in the plant of the Aktien Gesellschaft for the Manufacture of Aniline at Rummelsberg near Berlin in consequence of the operator having forgot to set the paddles in motion. For the same reason cooling by means of turbines has been found unsatisfactory. Recently, however, an apparatus free from this disadvantage has been invented by Kubierschky based upon the principle of his well known absorption columns and gas washers. The manner in which it operates has been recently described by A. Stettbacher in *Technik und Industrie.*

As shown in the accompanying diagram the apparatus consists essentially of three columns: A, in which the nitration of the benzine is effected; B, which is a washer in which the nitrobenzine formed in the column A is freed from the acids which it has carried down with it; and C, in which the nitrobenzine is distilled.

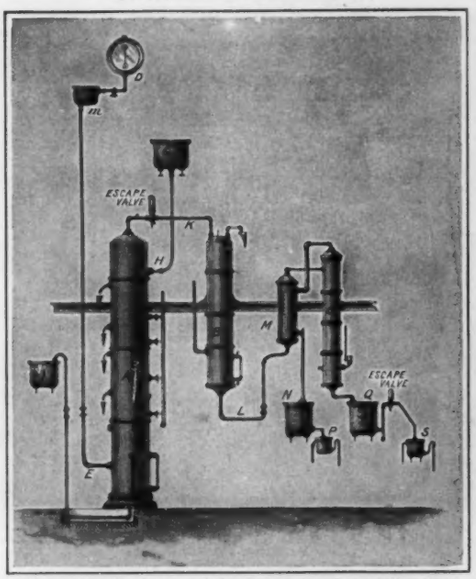
The dimensions and the relative position of these three columns have been so arranged that the liquids circulate from the first to the last merely through the force of gravity, an initial pressure being obtained by means of the glow regulator *m* for the benzine, and the reservoir G which contains the sulfonitric acid mixture. Furthermore the escape valves also ensure regularity of flow throughout the whole apparatus.

The benzine coming from the reservoir D, after having passed into the regulator *m* (which regulates both the flow and the pressure), passes through the pipe E to the lower portion of the nitration column A. The sulfonitric mixture passes from G into the upper portion H. Its density being greater than that of the benzine it traverses the latter and during its passage mingles with it little by little. The contact of the two liquids is made intimate by the presence in the nitration column of numerous plates which cause the acid to fall in a shower of drops. Thanks to this double circulation in opposite directions of the two liquids the reaction takes place progressively and can be entirely completed without large quantities of strong acid at any time coming in contact with large quantities of fresh benzine.

The dilute acid which results from the reaction collects in the container J; the crude nitrobenzine containing traces of acid issues by the pipe K, flowing into the washer B. The initial proportions of the liquid are such that it still contains an excess of about 10 per cent of benzine so as to avoid the formation of dinitrobenzine.

In the washer B, which is also provided with dripping plates, the mononitrobenzine circulates in the direction opposite to a current of water, which is less dense than the nitrobenzine. It flows out through L, passing into the distillation column C after having traversed a condenser M which is at the same time an exchanger of heat. In the column C it is subjected to an injection of water vapor introduced at the bottom. The benzine vapor carried along by the water is partially condensed in M and the condensation is completed in the refrigerator N. A closed separator P receives the condensed liquid, which consists of a mixture of water and benzine. Decantation is performed in P, the water collected in the lower portion makes its exit continuously by means of a siphon, while the benzine flows out at the top.

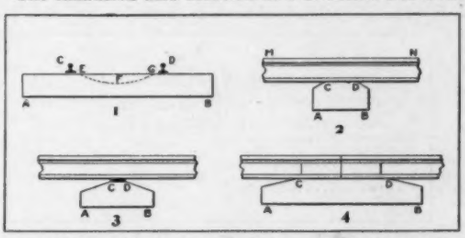
As for the nitrobenzine it issues purified but mixed with water at the bottom of the column C, and traverses the refrigerator . in which the water and the notrobenzine are completely condensed. The two liquids are separated from each other in the separator S in which the decantation and the evacuation are produced in the same manner as was the case with the water and benzine in the separator P.



The general scheme of the apparatus for continuous nitration. For the reference letters, see the text

The continuous cooling of the liquids in the column of nitration is insured by means of four cold water serpentines placed in the middle portion of the column. Their flow is regulated automatically by internal thermometers which set in action distribution sluices by means of electricity.

The exhausted acid collected in J is almost free from nitric acid; it is dilute sulfuric acid which may be used again in the manufacture after having been reinforced by the addition of oleum or sulfuric anhydride and of fresh nitric acid. Finally similar apparatus to that just described makes it possible to transform the mononitrobenzine into dinitrobenzine and the latter into trinitrobenzine.



To illustrate his suggested changes in the standard railway tie, a French investigator presents these diagrams, which are explained in the text

Improved Sleepers for Railroads

A FRENCH railroad engineer, M. A. Auric, has come to the conclusion that the present method of constructing roadbeds is faulty in principle and is largely responsible for the wear and tear to which they are subject.

His criticisms cover three main points, the rigidity of the cross-tie or "sleeper" in the longitudinal direction, the manner in which the rail is fastened to the sleeper, and the insufficiency of support at the junction of the rails. In a recent article in *Le Genie Civil* he supports his argument by the use of the accompanying diagrams.

Figure 1 represents the tie A B supporting the rails C and D. According to M. Auric it has been proven by experiment that the loads and the shocks which are transmitted simultaneously to the ties at C and D are never equal or even approximately equal; on the contrary almost the total amount of the load is transmitted integrally first at one point and then at the other, because of the unavoidable zigzagging, pitching, rolling, etc., in the motion of engines and cars. Because of the rigidity of the tie in the longitudinal direction these and uneven loads cause it to rise (and fall) now on one side and now on the other, and the incessant vibration thus occasioned tends to disturb the ballast of the roadbed and causes the fastenings of the rails to become loosened.

This disadvantage can be remedied, M. Auric believes, by the simple method of making the tie thinner in the middle, as indicated by the dotted line E F G, thus preventing the two ends of the tie from having too closely conjoined an action, and allowing them to act independently of each other under the strains and stresses imparted by the load.

Figure 2 represents the present method of fastening the rail to the tie in the transverse direction by means of cramp-irons, etc., fixed upon the upper surface C D of the tie, this upper surface having a width of 0.15 meters to 0.20 meters (5.8 inches to 7.8 inches).

Obviously, when the rolling load is at M to the left of C the tie will have a tendency to sink at A and to rise at B; when the load is at N to the right of D this action will be reversed; the effect of the constant oscillation is the same as in the preceding case, the loosening of the fastenings and damage of the ballast. The remedy proposed, and illustrated in Fig. 3, is equally simple, and consists merely in reducing the supporting surface C D to the minimum consistent with safety when suitably reinforced. The weight of the load will thus be transmitted as nearly as may be to the center of the base of support A B, which will have the effect of checking the vibration.

As regards his third criticism, the insufficient support of the rails at the point where they are joined, M. Auric proposes that cross-ties should be done away with entirely at such points and replaced by girders as shown in Fig. 4. At present the practice is to place the ties closer together at the joints than elsewhere, giving the rails wide bases of support. The longitudinal rigidity is thus increased with a corresponding increase of vibration. As a consequence it is precisely at these points that the roadbed is most subject to damage.

Building a Bridge by Halves

HOW can a bridge be opened to traffic before it is completed? The answer is simple and obvious: Build half of it at a time so that traffic can use the completed portion while the other half is finished in due course.

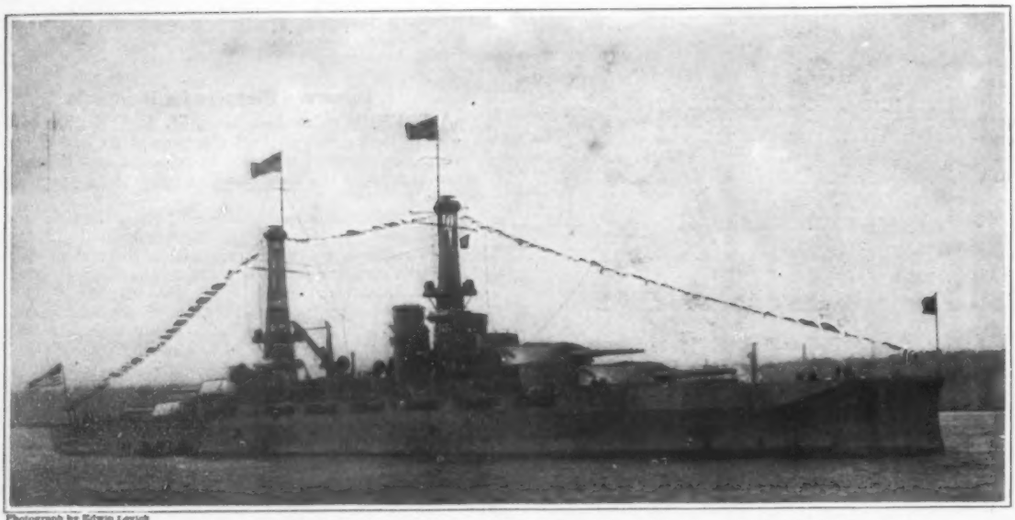
A typical case of bridge-building by halves is that of the attractive concrete structure recently completed across Lake Quinsigamond, at the eastern edge of the city of Worcester, Mass.

As will be noted in the accompanying illustrations, this bridge was so much in demand for traffic crossing the lake that half of it was completed, or from the elaborate arched face to the center line, including a single track for the street car line. The first half was completed and finished, even to the ornamental lighting fixtures and the asphalt pavement.

With half the Quinsigamond bridge opened to traffic, the builders turned their attention to the construction of the other half.

Above: General view of the Quinsigamond bridge at Worcester, Mass., showing the completed half and the remaining half in building. *At left:* Finished half of the bridge as seen from the bank. *At right:* Concrete forms in place on the unfinished side.

Three views of a concrete bridge which has been built by halves, for earlier opening to traffic



Photograph by Edwin Levick

The "Pennsylvania," flagship of Admiral Mayo. Displacement 31,500 tons. Mounts twelve 14" guns.

THE residents on Riverside Drive and Washington Heights, New York, have looked down, during the past quarter of a century, upon many a naval review on the majestic Hudson River; but never have they witnessed a gathering of the ships of the United States Navy to compare in numbers and strength with the fleet which was reviewed by the Secretary of the Navy on December 26, 1918. From 59th to 179th Street—a full six miles—there rode at anchor, in the center of the river a line of 20 battleships, and paralleling it on the Jersey side, was another line of destroyers, consisting of the fine, flush-deck, 1,200-ton vessels, of which are building over two hundred as part of our war program.

Holding the place of honor at the head of the line were the big dreadnoughts which that very day had returned from their 13 months of service with the Grand Fleet in the North Sea. These five ships, which were known as the Sixth Battle Squadron of the Grand Fleet, were anchored in the following order: "Florida," "Wyoming," "Arkansas," "Texas" and "New York." The squadron is under the command of Admiral Rodman on the flagship "New York." The next ship in line was the 31,500-ton "Pennsylvania," flagship of Admiral Mayo, commander-in-chief of the Atlantic fleet, which, with her sister the "Arizona," reached the North Sea after the signing of the armistice. The next three ships upstream were the "Utah," "Nevada" and "Oklahoma," which were stationed during the war at Beerhaven, off the southwest coast of Ireland, ready to attack any enemy raiding force that might threaten an approaching convoy. The eleventh and twelfth vessels were the two recently completed, electric-driven "New Mexico" and "Mississippi," of 32,000-tons displacement—the largest battle ships afloat. In the dozen ships above named are included the very latest and most powerful vessels of our dreadnought fleet, all but the last two of which had done service, during the war, in European waters.

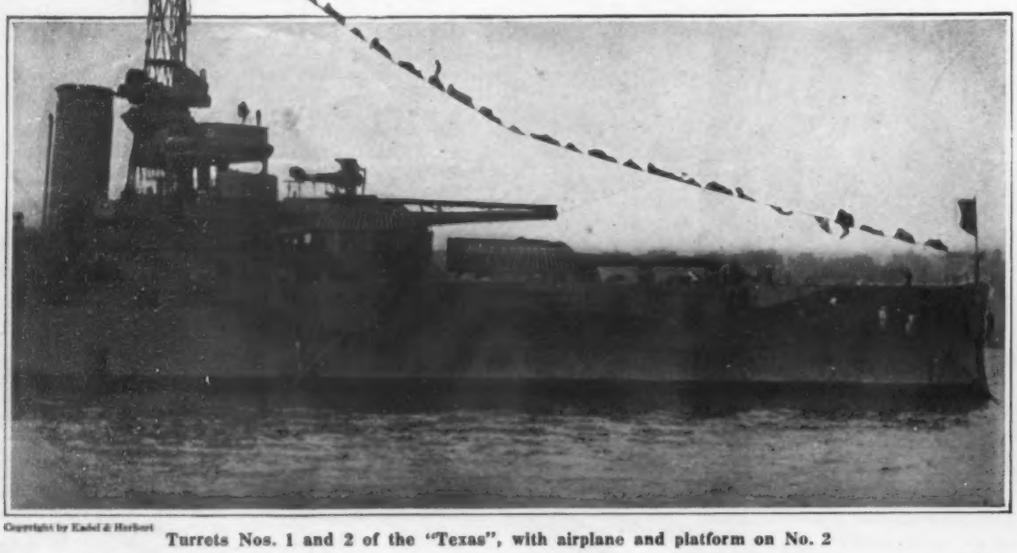
Then followed the older ships—the predreadnoughts—of which there were eight in line: the sister ships, "Missouri" and "Maine"; the sister ships "Wisconsin", "Illinois" and "Alabama"; the "Kearsage"; the "Iowa" and the "Indiana," which were in the battle off the south coast of Cuba, when Admiral Cervera made his gallant sortie from Santiago Harbor.

The particulars of the dreadnoughts are as follows:

	Tons	Battery	Belt	Speed
New Mexico Mississippi	32,000	12-14"	14"	21
Pennsylvania Arizona	31,500	12-14"	14"	21
Nevada Oklahoma	27,500	10-14"	14"	20½
New York Texas	27,000	10-14"	12"	21
Wyoming Arkansas	26,000	12-12"	11"	21
Florida Utah	23,000	10-12"	11"	21

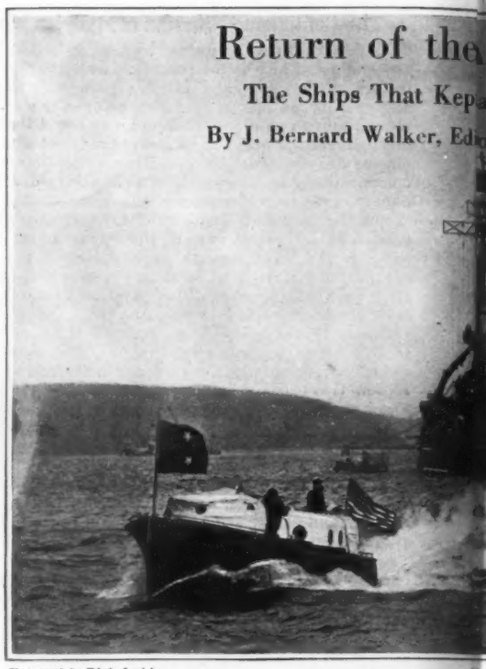
The predreadnoughts are well known to the readers of the SCIENTIFIC AMERICAN. Compared with the dreadnoughts they are obsolete. They vary from 11,000 to 13,500 tons in displacement, and from 15 to 18 knots in speed. They mount four short 12-inch guns in the main batteries, and from 12 to 16 short six-inch guns in the secondary batteries. The "Iowa" carries four 12-inch; eight 8-inch guns, and the old "Kearsage" and "Indiana" mount short 13-inch, 8-inch 4- and 5-inch guns. It should be noted that our later predreadnoughts of the "New Jersey" and "Connecticut" classes, 11 ships in all, mount four 12-inch, eight 8-inch and twelve 7-inch guns. They are 15,000- to 16,000-ton ships, with 18 to 19 knots speed. These latter vessels, not present at the review, form a strong second line of defense.

The chief interest centered, of course, in the ships of



Copyright by Kadel & Herbert

Turrets Nos. 1 and 2 of the "Texas", with airplane and platform on No. 2



Return of the

The Ships That Kep

By J. Bernard Walker, Ed

Photograph by Edwin Levick

The Atlantic fleet le

Photograph by International Film Service

Sub-caliber gun practice

Copyright by International News Service

Sunset on the Hudson,

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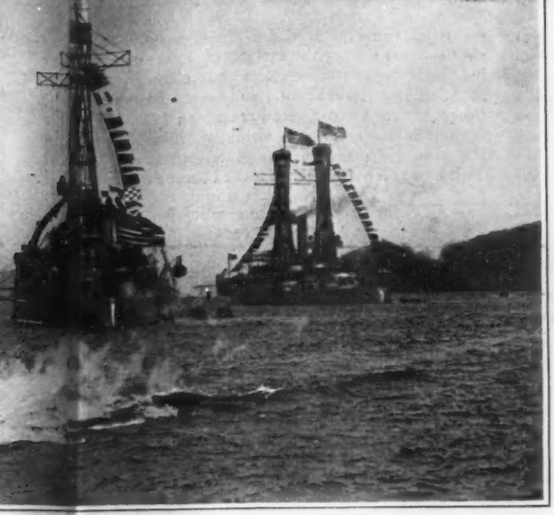

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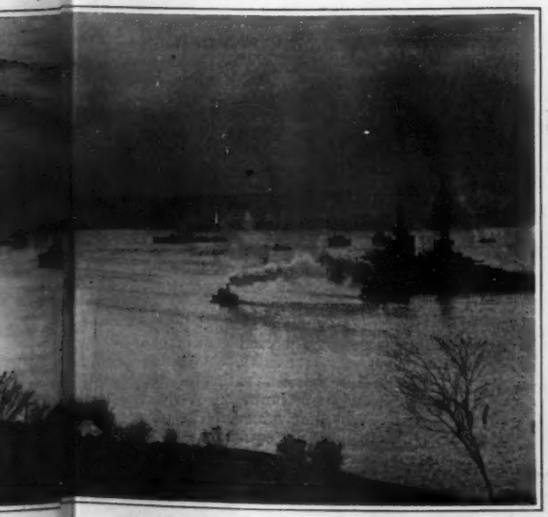
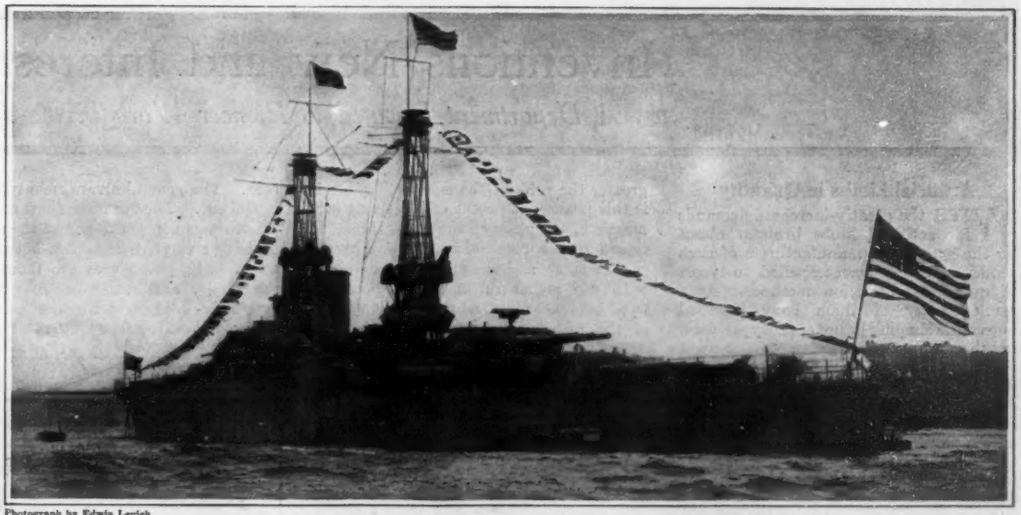


Hudson, the battleships in silhouette



Photograph by Edwin Levick

Our largest dreadnought "Mississippi" of 32,000 tons, carrying twelve 14" guns

the Sixth Battle Squadron, which had served with the Grand Fleet under Admiral Beatty for over a year in the North Sea. Later in this article we give extracts from Admiral Rodman's statement, which afford a vivid impression of the very arduous nature of this work; but just here we draw attention to some novel features which at once struck the eye of any student of warship equipment.

First to attract attention was a large dial on the masthead and a series of vertical stripes on the turrets and barbettes of our battleships. These were adopted as part of the Grand Fleet practice. They are for giving visual indications to other ships of the range and bearing (distance and direction) of the enemy ship which, let us say, the "Texas" might be engaging. The figures 8, 9, 10, 11 on the masthead dial represent the number of yards, 8,000, 9,000, 10,000, etc., distant of the enemy. The numbers on the barbette show the bearing in degrees, 20°, 40°, 75°, etc., of the enemy. This enables any two or more ships by observation of each other to concentrate and maintain their fire on any one vessel in the enemy line.

Another striking novelty was the two airplane launching platforms, built upon No. 2 and No. 4 turrets and extending out to the muzzle of the guns, a distance of about sixty feet. Above each turret was an airplane (not a seaplane). In launching, the turret is swung over, 20 or 30 degress to port or starboard, according to the strength and direction of the wind, so that the resultant of the ship's speed and the wind's speed shall be parallel with the axis of the turret. The plane is then released. So speedy are these machines, that they lift before the end of the platform is reached.

The two machines are for spotting. One is an observing and the other a swift fighting plane. The observing plane carries the spotter, the fighter—a 120-mile English "Camel"—protects it if attacked by enemy planes. The advantage of observing from a height of several hundred feet, as compared with the height of 120 feet of the fire-control platform, is enormous. Not only is the position of the splash with reference to the enemy ship ascertained with great accuracy, but it is possible to see over the smoke screens, such as the Germans used so effectively in the Jutland battle to hide themselves from the British fire.

It took very real heroism for the pilot to launch himself into the air for battle service, far out in the North Sea; for no return could be made to the same platform. When the service of spotting or scouting was concluded, the pilot had to make his way to the nearest shore—often 200 miles or more distant. If engine trouble ensued or gas supply gave out, there was nothing for the pilot but to drop into the sea, and hope for a friendly destroyer, scout, or merchantman, to sight him before the wrecked machine sank beneath him. The British lost many a gallant going chap in this service before they brought out their airplane carriers, with broad, long platforms for the landing of machines. Two of these were shown in our issue of December 21, 1918.

Admiral Rodman states that when our ships joined the Grand Fleet, they adopted the code, signals, etc., of the fleet, and had their regular position in the British fighting line. They found the fleet in a very high state of efficiency, with a great many devices and practices incorporated as the result of the experience gained in the battle of Jutland, especially in the matter of gunnery, which the fleet had brought up to a state of high efficiency. We are not permitted, for obvious reasons, to give any particulars; but ordnance experts will appreciate the fact that the average dispersion has been brought down to 200 yards.

The pennant for gunnery, by the way, is flown this year by the "Texas," which achieved results in salvo firing that would have been thought impossible when the writer witnessed our battle practice on the "North Dakota," in 1911. This ship got on at the first salvo with a "straddle" and followed this with a string of several straddles without a break.

A favorite lie of the German Admiralty, during the war was to the effect that the submarines had so scared the

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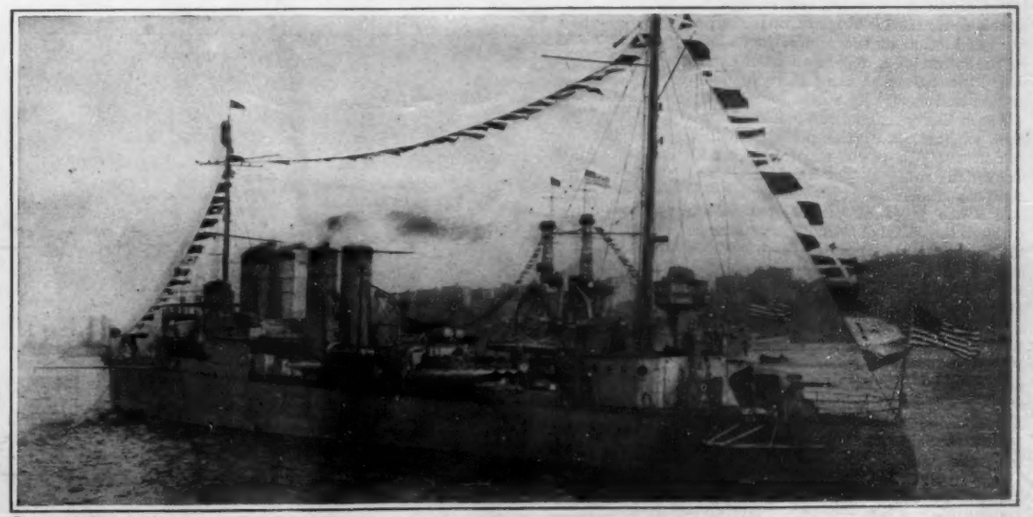

Photograph by Edwin Levick

One of our latest 1200-ton, 35-knot destroyers

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Artificial Limbs in Quantity

WITH the greatly-increased demands for artificial limbs brought about by the great war, manufacturers of such products have been compelled to resort to quantity-production methods. As a result, many of them have installed automatic shaping lathes of the type shown in the two accompanying illustrations. As will be noted, the operator places a roughly cut piece of wood in the machine, and then turns on the power. The cutting knives are guided over the rough piece of wood through the agency of a curved rod which rests against a master wooden leg held at the rear. Thus the cutters only remove as much wood as the master permits, and the result is an exact replica of any kind of limb held at the rear.

It will be seen that this is another application of the pantograph principle, which has been used so much lately—notably in making propellers.

Rough stock in place, ready to be shaped into an artificial leg

Rear view of machine, showing master wooden leg in place

The Rotary-Pole Magneto

A LARGE part of invention consists in mere mechanical improvement, a touch here, an added detail there, to make existing equipment function better. It is comparatively seldom that a brand new principle is laid down and applied; and this phenomenon is therefore the more interesting by virtue of its very scarcity. We imagine that it must have been in pessimistic brooding over this fact that the now famous patent examiner of the 1830's, who resigned because everything had been invented, reached his decision.

Perhaps it will not be going too far to put in the class of basic inventions the rotary-pole magneto developed since 1912; for while this apparatus, like older types, ignites the cylinder charge by means of an electrical spark, it makes, in the production of this spark, just about as fundamental a departure from established procedure as the nature of magnetism and electricity would permit.

The ordinary magneto embodies a horseshoe magnet, with the poles built out in concave pole-pieces to provide a seat in which rotates the armature. The magnetic flux that flows between north and south poles of the magnet passes through the metal of the core in preference to the atmosphere, because there it meets less resistance. But as the core rotates, the path through it of the flux must be reversed. While the shaded end E is in contact with the north pole N, in the left-hand diagrams, the flux enters at E and flows *from* E through the core; a moment later E is in contact with the south pole, and the flux must then flow through the core *toward* E.

The electric current induced, by the magnetic field, in a coil of wire exposed to the action of the magnetism by being wound about the core, has a maximum intensity when this reversal of flux takes place; and the sharper that reversal, the greater the peak of the current. Since it is this peak that produces the spark in a magneto, anything that operates to retard the flux reversal makes the current-peak weaker and the spark less efficient.

In the armature magneto there are two influences so working. The iron of the armature shows a tendency to maintain its polarity, a reluctance to reverse, which slows up flux reversal. And when the armature is in the third position shown, it is neutral; the ends are neither north nor south, but are in contact with both poles and trying to be both north and south at once. Flux then flows across the ends of the armature, and in both directions through its shank, making for gradual rather than sudden reversal. Indeed, this is actually the process of gradual vs. sudden reversal; so the peak of the current in the coil is comparatively weak.

In 1912 the first patent was granted for a magneto with rotary poles and fixed core. The general arrangement is shown in the cut. The rotating shaft runs from pole to pole across the gap of the magnet, no longer through that gap between the poles. The pole-pieces are mounted on the shaft, and when it rotates they rotate in contact with the poles. In place of the armature we have two field-pieces partly surrounding the middle of the shaft, just as stationary pole-pieces partly surround the armature. To make and break the magnetic circuit, each pole-piece has a lobe that projects, parallel to the shaft, far enough to brush the field-pieces in rotating. These lobes are opposite one another on the shaft, just as are the armature ends in the older type.

In operation, the rotary pole-pieces retain their polarity, without reversals. There is thus less reluctance because less iron has to reverse magnetically. Moreover, in this neutral position there is precision instead of confusion. The gap is now bridged by a piece of constant polarity, causing a definite magnetic short-circuit during the instant of bridging, with a scavenging effect that eliminates all stray lines of flux, and clears the decks for a sharp, clean reversal. A current intensity is thus obtained which the old-style magneto cannot approach. This means a better spark, more thorough ignition, more rapid and more complete combustion, and as a final consequence, more power.

Nor is this all. The armature magneto gives exactly two sparks for each revolution of the armature shaft—one for each flux reversal. But the tendency in engines is ever toward more cylinders, which means more sparks per revolution of the *engine* shaft. This demand is met by a gear between engine shaft and armature shaft, so that the latter turns faster than the former; but even with this, we have by no means disposed of the matter completely.

Engine speeds are always going up, too. A while ago a fair average was 1,200 revolutions per minute. Today few engines work at less than 1,400-1,500 revolutions; the Liberty makes 1,700; while the latest wrinkle of increasing power by gearing down from shaft to propeller requires that the engine speed up to 2,200 turns, or even more per minute. A multi-cylinder engine, with magneto operated on a 4- or 6- or even an 8-to-1 gear, will then mean anywhere from 6,000 to 20,000 revolutions per minute by the armature shaft; and this, in addition to its normal bearings, carries two pole-pieces that have contact over a broad surface with the fixed poles.

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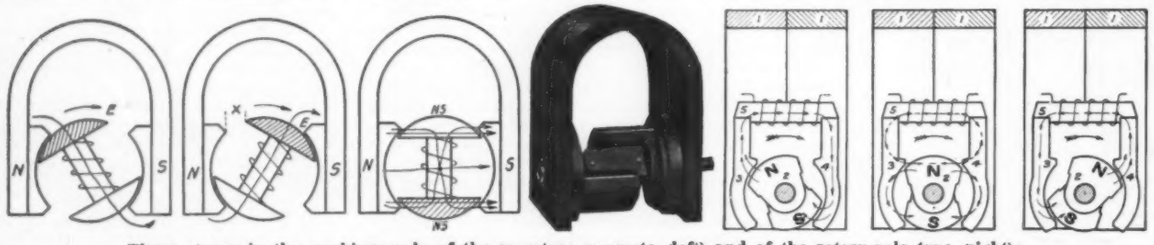

Three stages in the working cycle of the armature magneto (left) and of the rotary-pole type (right); and the general arrangement of the latter (center)

Logging by Electricity

BY converting waste lumber and sawdust into electrical energy, instead of feeding it into the refuse burner, a large sawmill company in western Washington is obtaining sufficient power to operate an electric logging donkey for hauling logs in the woods. This constitutes the first serious attempt at handling heavy Pacific Coast timber with electric power, where logs weighing several tons each are common.

Apparently doing anything a steam donkey will do, the electric machine possesses remarkable flexibility, throttling down to eight or 10 revolutions per minute when tightening up on its load, and consistently hauling in at a drum speed of 24 revolutions.

The motor was designed especially for logging service, by the engineers of one of America's largest electric companies, and has an intermittent rating of 200 horse-power, with an immense overload capacity not yet determined. The unit was built to be the equivalent of a steam installation with cylinder dimensions of 11 x 13 inches. The total weight of the machine is about 50,000 pounds.

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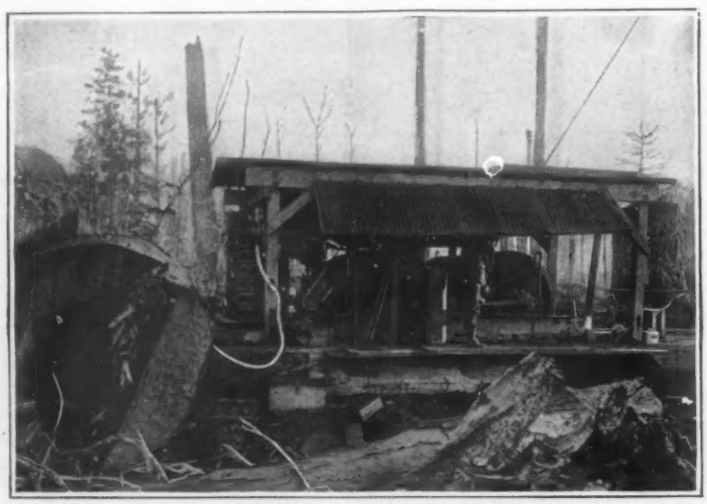


An electric donkey-engine for logging

Making or Marring the Strength of Steel

A PIECE of steel is a bundle of very short fibres, more or less hard according to the amount of carbon they contain, more or less strong according to their relation one to another.

When a blacksmith heats a bar red hot and forges it out into horseshoe shape on his anvil, all the fibres of the steel are bent into the horseshoe shape of the finished forging. They remain in proper relation one to another. There is no decrease in their strength.

If, however, we were to make a casting of this horseshoe, the fibres would run in various directions, and this would be a source of weakness. The metal would be hard, but brittle. This is why forging is superior to casting where both hardness and tensile strength are needed, and it is why forgings are now, to a very great extent, supplanting castings.

Now, even in forging, there is a right and a wrong way of hammering.

If the forging is ignorantly or carelessly made by a single great blow of a drop hammer, the outside fibres of the steel are more compressed than those on the inside.

If, on the other hand, the forging is made by a series of carefully calculated and nicely adjusted blows (such as only long experience can accomplish), the fibres are more evenly compressed throughout, and a finer grain and greater strength result.

By an intensive and exact knowledge of steel and its methods of treatment; by the ideal, best expressed by C. E. Billings when he said, "into every forging goes our entire reputation"; by half a century of steady progress since Civil War days, this company has reached its present position in the estimation of the world.

Triangle B forgings have made many a great industry possible by holding in leash forces which would otherwise have remained beyond the scope of humanly wrought strength.

The Billings & Spencer Co Hartford

B "RELY ON ME"

The First Commercial Drop Forging Plant in America

RECENTLY PATENTED INVENTIONS

Electrical Devices

OUTLET BOX COVER.—P. KLEIN, care of Morris Roth, 185 Duane St., New York, N. Y. This invention relates to electric wiring attachments and has particular reference to outlet boxes adapted for ceilings, walls or the like. Among the objects is to provide a type or design of outlet box cover having more reliable means for securing the cover to the box than is ordinarily employed.

Of Interest to Farmers

CUTTER BAR FOR MOWERS.—E. ANTE, Homestead, Ore. The invention relates to an attachment for mowing machines whereby a clear cut can be made at the outer end of the finger bar. An object is to provide an attachment which can be easily and quickly applied to a mowing machine, the attachment being in the form of an extension of the finger bar for making an upward cut at the end of the sickle bar.

COTTON CHOPPER.—J. H. DWIGHT, 479 Stewart Ave., Atlanta, Ga. This invention relates to implements for chopping out surplus cotton plants, and more particularly to an apparatus for this purpose, in which rotary chopping elements are arranged to turn about a vertical axis, and to have an up-and-down movement to give the chopping action. The machine is provided with a harrow at the front arranged to be adjusted laterally, and cultivator shovels at the rear of the chopper.

Of General Interest

ARMBAND.—L. F. NELSON, P. O. Box 692, Bremerton, Wash. The invention relates more particularly to that type of sleeve supporters in the general form of a resilient band to encircle the arm and support the sleeve in adjusted position. The prime object is to provide a band in

A PARTLY SECTIONAL SIDE ELEVATION

which clamp jaws are incorporated, adapted to grip the material of the sleeve in addition to the holding action due to the resiliency of the band as a whole.

FILING DEVICE.—E. E. RETTIG, Keytesville, Mo. The invention relates to filing devices in the form of a spindle or rod on which letters, bills, accounts, cards of card systems, or like articles may be placed. The prime object is to provide a file in which relatively movable sections are arranged in a novel manner to permit ready access to and removal of any particular letter or the like without tearing.

STARRING MIXTURE FOR ANTIMONY SMELTING.—CHUNG YU WANG, Panoff Garden, Rice Die Sargon, Kankow, China. An object of this invention is to produce a slag or starring mixture which does not contain any antimony compound. Another object is to utilize a by-product of the refining of antimony, which is at present discarded as useless. The mixture is composed of iron sulfid resulting from the precipitation process of antimony smelting, and an alkali metal carbonate.

SAMPLE TAB.—B. F. STENE, 644 First Ave., New York, N. Y. The object of this invention is to produce a sample tab so constructed that not only will there be a saving in the cost of the materials used, but a sample had which shall be of lighter weight and will lie flatter as compared to those made heretofore, and by the use of which a saving in the cost of transportation will be effected.

PICTURE HOLDER.—Z. OBIZAROFF, 200 S. Front St., Steelton, Pa. This invention relates to hangers or holders for picture frames, mirrors, ornamental panels, or the like, it has particular reference to hangers that are adapted to support the picture frame from the side edges of the upper portion without cords, wires, screw eyes or the like being attached thereto.

ROLLER BEARING.—A. GOLDEN, 945 Hoe Ave., Bronx, N. Y. The object of the invention is to provide a roller bearing arranged to permit of conveniently handling the bearing as a unit and without danger of the rollers becoming displaced. In order to produce the result use is made of outer and inner bearing rings, rollers interposed between the bearing rings, the rollers and one of the bearing rings having annular registering grooves, and a split ring engaging the registering grooves to hold the rollers in assembled relation.

HOG FEEDER.—F. H. PAGE, Waverly, Iowa. The invention more particularly relates to a feeder arranged in connection with a hopper to be actuated by the animal for feeding a limited

A VERTICAL SECTION OF THE FEEDER

quantity at each operation. An important object is to provide a feed device with actuating means so formed as to bring about the operation thereof by the snout of the animals approaching the feed outlet, the device is so arranged as to prevent clogging or packing of the feed.

WHEELED GUN CARRIAGE WITH WIDE SCOPE OF FIRE FOR FIELD ARTILLERY.—E. RIMAILHO, Paris, France. The object of the invention is to construct a wheeled gun carriage comprising an axle wheel member, and a trail frame member, said trail frame provided with diverging tubular arms provided with a housing at their free ends within which trail beams are mounted to swing and have longitudinal sliding movement, and supporting guides carried by the axle wheel member to receive the trail beams when so slid.

PLOTTING BOARD.—J. D. MCCABE, 1315 Union Bank Building, Pittsburgh, Pa. This invention relates to a plotting device, the object being to provide a construction whereby deed

A TOP PLAN OF THE DEVICE

descriptions may be properly plotted without resorting to anything except the use of a pencil and paper. Another object is to provide a device which may be taken to the recorder's office and a given piece of land properly plotted on a piece of paper practically from the record whereby errors in transcribing will be eliminated.

Hardware and Tools

REAMER FOR OIL AND GAS BEARING SAND.—A. OTTO, 209 Scaritt Building, Kansas City, Mo. The invention relates to appliances for oil wells, its object is to provide a construction for removing part of the gas and oil-bearing sandstone of an oil well so as to allow a free flow of oil and gas. Another object is to provide a reaming device furnished with a centrifugal reaming structure, and means for removing the removed sand and deposit.

PLANKING CLAMP.—T. E. MAZIER, Box 536, Madisonville, La. The object of the invention is to provide a device for clamping planks in position on a ship or any other structure and holding the same in place while permanent securing means are provided. Another object is to provide a clamp which may be mounted substantially at any point on a ship or other structure for holding a plank in position temporarily on flat surface, a concave, or a convex surface.

SECTIONAL LINK.—J. M. THOMSON, care of Box 16, Sourlake, Texas. The object of this invention is to provide a sectional link adapted to be readily opened and locked to hold the parts in coupled relation. Another object is to provide a link more especially designed for use in oil well drilling tools, to prevent bending of the link and throwing it out of alinement with the connected parts when subjected to a heavy pull or strain.

BRAKE AND LOCK FOR SLIDING SASHES.—E. M. HICKS, 5180 Liberty St., Schenectady, N. Y. The invention relates to means for holding sliding window sashes when open to any desired extent and for locking the sashes in the closed position. The invention particularly relates to sash attachments involving the use of brake or stop elements adapted to frictionally engage a guide rod on a window frame for holding the sashes in any given adjustment.

CUT GAGE FOR MACHINE TOOLS.—B. NEFEDON, care of General Delivery, Ansonia, Conn. Among the principal objects of the invention are, to furnish means for accurately disposing the lathe cutting tool to the work to be performed, to indicate optically the extent of movement of the tool, to rapidly adjust the tool to the work required, to avoid overcutting by the tool, and to simplify the construction of the gage for setting the tool

Heating and Lighting

GAS BURNER.—R. V. HOWES, address H. E. Almberg, care of Consolidated Gas Co., 130 E. 15th St., New York, N. Y. This invention relates to burners which may be used in any stove or range constructed for burning coal, gas, wood, or oil. An object is the provision of a gasburner using a combustion mixture and certain arrangement of pipes and heat retaining material whereby an auxiliary supply of heated air is provided adjacent the supply or mixture of air and gas so that a maximum combustion is secured and consequently a maximum heat procured from a given volume of gas.

STREET LAMP.—F. MILLIKEN, 55 John St., New York, N. Y. The invention relates to improvements in street lights of the type disclosed in patent No. 1,264,114 issued April 23d, 1918, to the same inventor. Among the objects is to provide a street light with the head or casing movably mounted on a standard whereby the signs on the different sides of the casing may be moved by a traffic officer for controlling the traffic while not in any way interfering with the action of the light.

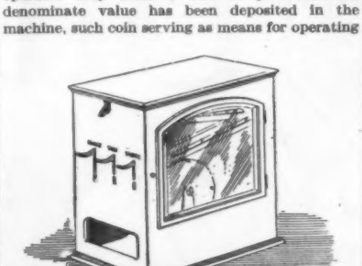
Machines and Mechanical Devices

WELL DRILLING MACHINE.—W. C. SOLE, 114 No. French St., Sullivan, Ind. The object of the invention is to provide a portable well drilling machine. The machine is provided with a calf reel, and in the rear of the calf reel a bull reel, the calf reel having a casing line and the bull reel having a drilling cable. On the calf reel is mounted a spudding pulley under which the drilling cable may be disposed, so that the calf reel may be rocked by means provided for the spudding purposes.

NEWSPAPER VENDING MACHINE.—O. J. HOTALING, 420 Ogden St,, Newark, N. J. A specific object of this invention is the provision of means for supporting a pile of papers on their edge and with their ends overhanging or projecting beyond their support, whereby a simple, and effective dispensing element can engage the outermost paper and swing the same off the edge of the support, so that it will drop out of the dispensing opening of the cabinet.

REVERSE WINDER FOR FILMS.—P. J. PROKOP, 561 W. 143d St., New York, N. Y. Among the objects of this invention is to provide winding apparatus for moving picture machines, in the nature of a receiver into which the film from a projecting apparatus is conveyed and wound in such a manner that the advancing or first picture end of the film will lie on the outside of the roll ready to be delivered through the projecting apparatus for a subsequent run of the picture without rewinding as is the usual practice.

VENDING MACHINE.—I. GONICK, 4023 N. 30th St., Omaha, Neb. Among the objects of the invention is to provide a vending machine in which a novel delivery means is used, which is operable only after a coin of predetermined denominate value has been deposited in the machine, such coin serving as means for operating



PERSPECTIVE VIEW OF THE MACHINE

the mechanism for releasing the article delivering device. A further object is to construct a supporting means in such manner that adjustments for receiving boxes of various dimensions may be acquired. The machine is designed especially for delivering shoe dressing contained in boxes.

COAL SEPARATOR.—M. H. REAP and J. R. FLEMING, 801 Monroe Ave., Scranton, Pa. Among the principal objects of the invention are to increase the capacity of separators, to support the base mineral and coal without congesting the mineral delivery, and to simplify the construction of the separator. The device comprises a plurality of inclined spiral flights, and a hollow tubular supporting mast, the mast being provided with a series of openings adjacent the lower inner edges of the flights for extracting the base mineral from the mixed materials.

FRAMING DEVICE.—F. C. TAYLOR, address Chas. K. Frankhauser, 450 Fourth Ave., New York, N. Y. This invention relates to a framing device for moving picture machines, the object is to provide a simple and inexpensive device with which the framing of the picture on the film can be accomplished with great ease and comparatively no strain on the film.

WORKMAN'S STAND FOR GAS ENGINES.—J. H. STALEY, care of Continental Auto Parts Co., Knightstown, Ind. The invention relates to a stand designed for use in workshops or manufacturing plants for the purpose of supporting an internal combustion engine or other motor in a manner to enable the workman to operate it in a most convenient manner. The invention has for its general object to improve the construction of stands so that they can be capable of holding various types of engines in such manner that the engine can be completely reversed or turned upside down, and locked in any desired position.

PEBBLE OR BALL MILL.—C. H. STAVE, Box 2, Thornton, Ill. This invention particularly relates to a mill designed to reduce chemicals or other material to fine powder. The prime object is to provide a pebble or ball mill in which the drum or cylinder will be disposed with its axis transecting the axis about which the mill turns whereby to effect increased reducing action by a more frequent and more thorough tumbling of the reducing elements and the material.

Prime Movers and Their Accessories

POWER TRANSMISSION AND SPEED CHANGING MECHANISM.—S. V. DICKMAN, address J. S. Dickman, Margaretville, N. Y. The object of the invention is to provide a power transmission and speed changing mechanism for use in automobiles, aeroplanes, and other power driven vehicles and machines, and arranged to transmit the power from a motor or a driving shaft to a driven shaft without appreciable loss and to permit the operator to readily vary the speed to any desired degree or to reverse the motion of the driven shaft.

Railways and Their Accessories

AUTOMATIC TRAIN SIGNAL.—M. B. BULLA, 216 Martin Building, El Paso, Texas. This invention relates to safety appliances for railways and has particular reference to an automatic railway track safety brush, serving either to give indications of signals to the locomotive driver or to insure the operation of automatic train stops although the breaking or stopping mechanism that may be relied upon are not indicated in this particular instance.

Pertaining to Recreation

BASEBALL GAME APPARATUS.—H. T. BUCK, 539 Broadway, Brooklyn, N. Y. The object of the invention is to provide a baseball game apparatus more especially designed for the use of two players located at opposite sides of the game table, which represents a baseball field, the apparatus being arranged to require considerable skill on the part of the players to successfully play the game according to standard or league rules.

Designs

DESIGN FOR A SHIRT OR SIMILAR BODY GARMENT.—W. H. DUTCHER, address Chas. Scarl, 1548 President St., Brooklyn, N. Y. This body garment design provides maximum

DESIGN FOR SHIRTS

comfort to the wearer at the arm pits and shoulders, and enables the cutting to result in a vast economy of material, as shown in the illustration.

DESIGN FOR A TOY HEAD BLOCK.—R. E. HUMBERT, care of De Witt C. Baker, Baker & Bennett Co., 873 Broadway, New York, N. Y.

DESIGN FOR A PLATE, PLAQUE, OR SIMILAR ARTICLE.—T. S. MARTIN, 391 Webster Ave., Bronx, N. Y.

The American Ace of airplane ignition

Victor in a thousand battles!

Leader by right of achievement!

Holder of flying records!

Reliance of airmen the world over!

The magneto, recognized by every fighting nation as the incomparable form of ignition, has the Aero Dixie as its supreme representative by virtue of its selection as standard equipment for aircraft engines by the U. S. Government.

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Reconstruction

A Department Devoted to the Improvement of Old and the Development of New Lines of Manufacture

IN our issue of December 14th, we announced a new department aimed to assist in the reconstruction of our industries in these unsettled days following the signing of the armistice. Many letters have come to the Reconstruction Editor commending the SCIENTIFIC AMERICAN for undertaking this service. Manufacturers who have built up organizations for the production of war material and are now seeking new lines of manufacture adapted to the machinery with which they are equipped, have written the Editor for information regarding promising inventions and for suggestions on new lines of manufacture. Responding to these appeals, our readers have offered many interesting ideas covering a very wide range of subjects.

Manufacturers' Problems

Manufacturers are urged to tell the Reconstruction Editor their needs. He will be glad to help them with their problems, and if they so desire, will withhold their names from publicity so that they may not be deluged with a flood of correspondence from impractical inventors. By stating in detail just what their problems are, what is their equipment for new work, and the character of the work they would like to take up, they will facilitate the task of the Editor, and eliminate much useless correspondence.

Methods of Presenting Ideas

Inventors are urged to exercise judgment in presenting their wares. A well developed invention that can be demonstrated with a model is far more likely to receive consideration than one which merely exists on paper. A photograph and blue prints of working drawings are far more convincing to the average manufacturer than a patent drawing. One correspondent submits his patent claims without any accompanying illustration. Some of our correspondents have offered good suggestions which they confess are not protected by patents. Some have tried to sell mere ideas, not embodied in any concrete form—ideas so vague that it would require the exercise of inventive faculties to develop them sufficiently to be patentable. Obviously such suggestions are practically worthless.

The average manufacturer is not an inventor. He does not care for abstract ideas. Inventions must be presented to him in concrete form. He wants to see the patents that cover the inventions because a patent is evidence of novelty and a guarantee of protection from competition. But in order to gain an adequate conception of the invention, he must have it well pictured and preferably embodied in a working model.

Those who are prepared to submit a working model should so state in their letters. *Do not send models to the Reconstruction Editor.* He cannot handle them. Instead, send him photographs of models.

Clearing House of Progress

The aim of the Reconstruction Department is to become a clearing house for useful and progressive ideas—to bring about a closer coöperation between inventor and manufacturer—to bring the manufacturer in touch with useful inventions, and the inventor in touch with manufacturers' needs.

The Reconstruction Editor cannot attempt to answer all of the letters sent to him, but he will see that those which are in proper form are forwarded to manufacturers who are likely to be interested in their subject matter.

Here are a few of the many scores of interesting letters which the Reconstruction Editor has received:

The Municipal Reference Library

To the Reconstruction Editor of the SCIENTIFIC AMERICAN:

In the current issue of the SCIENTIFIC AMERICAN I note the announcement of a new department devoted to reconstruction problems recently started under your direction, and wish to extend to you the compliments of civic workers generally upon this far-sighted action.

The Municipal Reference Library has given considerable attention to the problems of reconstruction and we have compiled extensive references on the subject. We have recently published a special reconstruction number of our weekly bulletin which perhaps may be of some use in connection with this work.

DORSEY W. HYDE, JR.
Librarian.

Municipal Reference Library,
512 Municipal Building,
New York City.

Wanted: A Factory

To the Reconstruction Editor of the SCIENTIFIC AMERICAN:

We note in the SCIENTIFIC AMERICAN of December 14th, a notice on page 485, under head of Reconstruction, to which we reply:

We have perfected and patented in the United States, and applications for patents have been made in several foreign countries, for an automobile non-puncture, non-blow-out, resilient tire. This tire is a *proven product* and now ready to be manufactured for the market. We have had sets of tires running on machines since last March, and are now making molds to manufacture tires; also, we have arranged with a tire plant to manufacture under our own supervision tires in a small way until we get into a plant of our own. We are incorporated under the laws of the state of Virginia and have been closely investigated by the State Corporation Commission of this state and granted a permit to sell stock. We have not as yet decided on a location for our plant, but have had offers from several cities. However, we are investigating all places from every source that will be of greatest benefit to our corporation before we decide on a permanent home for our plant, shipping, labor conditions, etc., etc. Our proposition means much to the community in which it is finally situated. We are open now for correspondence with factory firms who may have capacity plants for an industry that is all and more than is or has been expected in the touring car and truck tire world.

A Safe for Liberty Bonds

To the Reconstruction Editor of the SCIENTIFIC AMERICAN:

On page 485 of your December 14th issue there is a request from a manufacturer for suggestions as to metal articles that could be sold in large numbers with proper advertising.

For several years I sold hardware over the counter and on the road, and for the last few years was buyer and sales manager for a large wholesale and retail hardware house. One of the items that I always felt should be on the market is a good substantial metal box to hold valuable papers for household use. Such a box should be of pressed steel of a gage sufficiently heavy so that it would keep its shape and its cover stay on and fit properly in spite of any ordinary accident. The weight would also give the purchaser a sense of security and would protect the contents much more thoroughly from fire than do the thin tin boxes on the market.

Because so many millions of people now own Liberty Bonds and have been awakened for the first time to the need of some protective, substantial box to keep them in, together with other valuable papers, I think that advertising would sell several millions of a box of this type. It should be nicely enameled in black and have a good lock and key. It should retail at not over $2.00 each and can be made very profitably to sell at that price, if the manufacturer's agent, the jobber, and the retailer do not all tack on an exorbitant profit. If I were making them I would sell direct to the consumer, paying the parcel post charge.

I have always thought an 8-inch oscillating electric fan of the best type would sell in enormous quantities if made to retail around $10. Millions of possible users of these fans have been deterred from buying them by the prohibitive prices asked for standard makes. The low priced fans that are on the market are altogether too small and poorly constructed to be useful or salable in large numbers.

A good sanitary fireless cooker to sell for not over $10.00 would be a boon to hundreds of thousands of housewives, and the biggest economy they could possibly put into their homes. I firmly believe that someone will make a proper fireless cooker, advertise it thoroughly, and sell an immense number, because such a cooker is scientific, saves fuel, labor and worry, cooks food better, and is advertised by everyone who owns one.

Electric Farm Lighting Equipment

To the Reconstruction Editor of the SCIENTIFIC AMERICAN:

We are manufacturing an electric farm lighting and automatic electrically operated water supply system on which we have several patents filed. The outfit is the simplest so far designed for furnishing private utilities to country homes, stores, gins, sawmills, isolated factories, etc. It contains 40 per cent fewer parts than any of its few competitors and is a Ford idea in its field in that it lends itself to big quantity production and at a marketing price which would undersell anything in its field.

We cannot begin to supply the demand in one state alone, and due to the adverse manufacturing conditions in the South for producing equipment of this kind, as well as the fact that the resources of a $50,000 company are wholly inadequate for a product of such uncommon merit as ours for nationalizing and handling as Big Business in a big, successful way, we are planning to consolidate with an established manufacturer of large resources and organization, or have our system taken over by a big corporation to manufacture and merchandise.

Our product lends itself ideally to big volume production to undersell competition and to dominate its field which is potentially of enormous possibilities and at present of negligible competition.

If you care to coöperate with us in our plan detailed information will be gladly given.

Electric Cast Iron Made from Steel Scrap

A DEVELOPMENT of war conditions in the steel industry of the United States has been the demonstration of the possibility of making pig iron and iron castings direct from steel scrap in an electric furnace—something never accomplished before. It has been claimed that such iron, cast in the form of castings, is far superior to the same castings made from ordinary pig iron, melted and cast. Tests of this new iron recently made at Columbia University demonstrate its high quality. Its tensile strength was shown to be 40,730 to 45,030 pounds per square inch, considerably higher than of ordinary cast iron.

Old Names for a New Navy

(*Continued from page 27*)

militarist, Napoleon. Leviathans of the British Navy also advertise native prowness and bull dog tenacity; witness "Tiger" and "Lion," "Valiant" and "Vengeance," "Audacious" and "Revenge," "Thunderer" and "Triumph," "Indefatigable" and "Indomitable" and "Invincible."

The French show an equal pride in great historic figures and epochs when seeking ship titles, but leaders in thought and civic action furnish inspiration as well. Under the tricolor float the "Charlemagne," "Jean d' Arc" and "St. Louis," reminiscent of empire building and of the Crusades. "Henri IV" tells the story of romantic Navarre's rise to be one of the greatest kings of France, while "Charles Martel" reminds the beholder of the hero of a decisive battle of the world, the victory over the Saracens at Tours in 732. Over the "Conde" falls the shadow of the greatest of a great military family, and the "Massina" and "Carnot" breathe memories of the Napoleonic era. On the other hand, mammoth dreadnoughts, predreadnoughts and battleships proudly ride the waters bearing the names of the philosopher "Diderot" ("Who aspired to the glory of Plato yet did not blush to imitate Plautus") and the statesmen of Revolutionary times, "Condorcet" and "Vergmaud." The "Voltaire" and "Victor Hugo" recall not only two of La Belle France's most noted sons, but two of the most noted men of letters of any age and land. The "Gambetta" and "Ferry" suggest two world-famous statesmen of the early eighties, while "Truth" and "Justice," "Democracy" and "Republic" proclaim the exultation of a country released from the autocracy of empire into the joys of freedom.

Quite the same catholicity of expression is found in Italy, which places the "Julius Caesar" and "Andrea Doria," namesake of Charles Fifth's imperial admiral, alongside the "Garibaldi" and "Cavour," respectively illuminated by thoughts of the fiery nineteenth century republican and the astute father of today's united Italy. Two other notable contrasts appear in the "Marco Polo," substantial ghost of that wonderous thirteenth century traveller, and "Leonardo da Vinci" redolent of the genius of the Renaissance; and then there is the "Columbus," launched in the same class as the "Dante."

The Dutch, always a nation of seamen, honor their great admirals in the "Tromp" and "De Ruyter," and Germany, appropriately enough, has graved upon her latest gigantic instrument of present-day frightfulness, "Hindenburg." Former military crises in the life of this nation are celebrated in the "Frederick the Great" and in the "Moltke" and "Roon," Bismarck's great coadjutors; while the romance and poetry of the people shine forth in "Siegfried," "Odin" and "Undine."

The component parts of the early United States navy evidenced in their titles the simplicity and vigorous atmosphere surrounding our ancestors. Besides the five now to be recalled by the new battle-cruisers, the stars and stripes floated over the "Wasp" and "Hornet"—"simple" perhaps, but "vigorous" certainly. In the war of 1812 both of these somewhat fiery insects distinguished themselves as sharply as was fitting; the one capturing the British ship "Frolic" while the "Hornet" stung the "Peacock" into a watery tomb. Then there were the "Scorpion" and "Asp," veritable watch dogs of the sea (to mix one's metaphors a little). The "Alliance," named in honor of the bonds of friendship cemented with France in 1778, twice bore the fortunes of Lafayette across the Atlantic, under the command of Commodore "Jack" Barry. Stephen Decatur, in the old "United States," deemed the fastest vessel of her time, conquered the English "Eurydice" and "Atlantic" during the second war with George III, while the "Congress" did a generous share in upholding the dignity of the infant American Republic. Signers of the Declaration of Independence were represented in the "Adams" and the "Hancock"; the "Randolph" was called after the Virginia family which subsequently gave to the world John of Roanoke—and perhaps it was in melancholy anticipation of the irrascible tendencies of this celebrated publicist that the frigate blew up during the struggle of '76 in a battle with John Bull's "Yarmouth."

The memory of Lawrence is indissolubly associated with the sanguinary conflict between his ship "Chesapeake" and the British frigate "Shannon," while that of Perry belongs to the great victory of Lake Erie and his "Lawrence" and "Niagara." It was during that same war of 1812 that there appeared the valiant little schooner "Surveyor" which captured the "Narcissus," flying England's Jack.

Are there not many names of this roll of honor well worth reviving among our modern sea fighters? For example, how much more effective for submarines than the uninspiring C plus a bald number would be the "Wasp" or "Asp" or "Scorpion?"

It is a large pity that the present fleets of the United States so slightly reflect the mighty history with which she is endowed. Among smaller craft are to be found indeed "Bainbridge," "Barry," "Decatur," "Lawrence" and "Farragut," but there are more full as worthy to be borne by our present-day sea fighters. One looks in vain for a "Washington," "Madison," "Lincoln," "Polk" or "McKinley," beneath our blue Jack, yet they were the Presidents identified with the five great war crises of our past, and four of those struggles, at least, were fought in generous part on the water.

Naming a ship does not call for so highly developed a genius in kaleidoscopic phonetics as does Pullman car christening, but none the less is it a matter of far more importance than may appear at a casual first glance. So Secretary Daniels' move in the matter of these battle-cruisers is one to be emphatically commended. It is to be hoped it may portend yet further advances in a good direction.

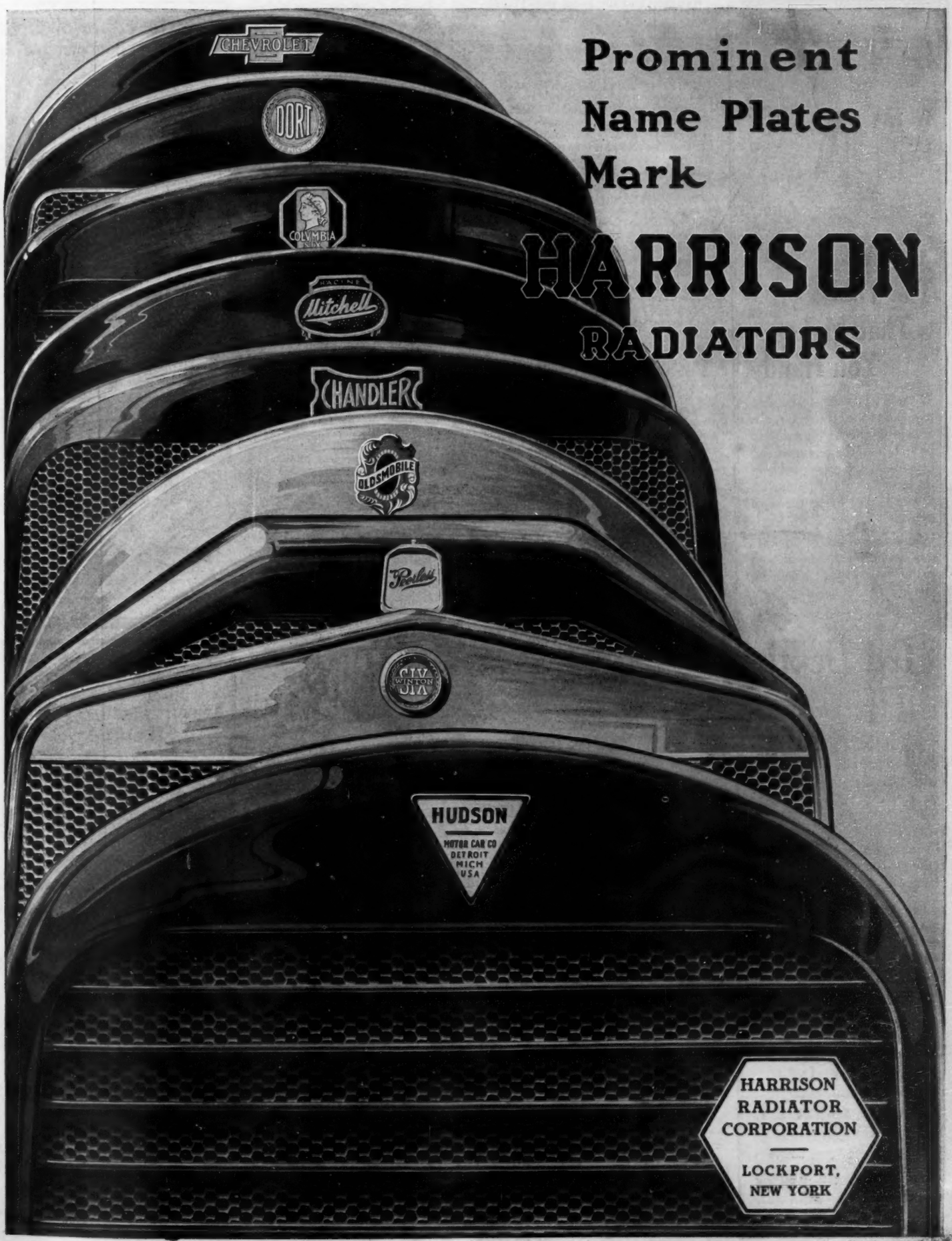
Weeding Out the Poisonous Fishes

(*Continued from page 29*)

it were. *Polypterus* is another edible African fish which can stay out of water several hours. When approached, it raises its long dorsal fin and strikes with its spines, lacerating the hand." Here we have both poisonous spines and teeth. The more imposing African fish of the fresh waters is *Hydrocyon*, with teeth as large and cutting as a man-eating shark's, conical, the outside row projecting out of the jaws and the inside row lying down to take the place of the outer teeth when destroyed. It is as poisonous as a shark.

Dr. Hugh M. Smith, Director of the Bureau of Fisheries, Washington, describes many of the ray fishes, which, however edible in some of their parts, and however valuable for their skins as leather, are dangerous customers, causing septic poisons by their stings or bites or both. The Torpedo fish ranges from 30 to 100 pounds in weight. "The fish is able to emit a very strong electric discharge from a large organ situated on either side or just back of the head. The shock from a large fish can knock a man down." The electric rays have two-spined dorsal fins for stinging. The rayfish *Dasyatis* ranges up to twelve feet in length, having the usual barbed spines at the base of the tail for stinging. The whipray of this genus uses its tail as a whip, jabbing its barbed spines into its victims, with power sufficient to pierce leather shoes or rubber boots. The powerful manta, or devilfish, posseses a single stinging spine, also a series of teeth which may well be avoided. Specimens weighing five tons are common south of North Carolina. The spotted eagle ray has its caudal spines serrated, cutting sharply its victims, and it also possesses a

(*Continued on page 48*)


CHEVROLET
DORT
COLUMBIA
RACINE
Mitchell
CHANDLER
OLDSMOBILE
Peerless
HUDSON
MOTOR CAR CO
DETROIT
MICH
USA
Prominent
Name Plates
Mark
HARRISON
RADIATORS
HARRISON
RADIATOR
CORPORATION
LOCKPORT,
NEW YORK

Weeding Out the Poisonous Fishes

(Continued from page 40)

median row of very broad teeth, flanked by several rows of smaller, narrow teeth. None of the above are true fishes. Some of them reproduce by eggs encased in a leathery capsule and others bring forth their young alive.

Just how numerous poisonous fishes are will be better known when Dr. Gudger and others finish their investigations. Far more dangerous to the public, perhaps, are our edible fishes which have become infested with minute worms that act as disease carriers of toxic bacteria. These disease carriers go generally under the names of cestodes, nematodes and trematodes. The nematode is a known carrier of the germ of cancer. A government report of several years ago, showed that all American trout hatcheries had become infected and that cancer in trout was spreading into the fresh water streams and also largely infecting some of the species of salmon. Trout of large bodies of water and salmon taken in salt water were not shown to be so affected. In July and August, all species of edible fish, perch, bass, etc., in small, shallow lakes and slow moving streams, are known to be dangerous to eat, their flesh being permeated with minute worms.

Something like seventy species of fish parasites have been enumerated, making dangerous for food, fishes of sluggish inland waters. As a rule, fish from deep salt water are most immune from parasites, if butchered when taken from the ocean. These forms, however, which pass from salt water, through brackish water (mixed salt and fresh) into sluggish waters, are liable to be dangerous to eat. The same is true of these fish that pass into streams or lakes infected with poisonous wastes from factories or which live naturally in such waters.

Some forms of fish, bivalves, etc., become infected with the germ of typhoid. This has been especially true of such bodies of factory- and sewage-polluted waters as Long Island Sound. No body of water extant has produced so many cases of typhoid in humans as the soft and hard clams and oysters of Long Island Sound. A good second is Lower New York Bay, reeking in sewage and pollution from factories. It is a crime to allow bivalves from such sources to be sold in the markets. The State of New Jersey has likewise had a hard struggle to rid its bivalve industries of the lower Delaware River and the indentations of Delaware Bay of typhoid infected products. The state has been forced to give great care to its natural oyster beds and to the places where it is allowed to plant seed oysters. This has required enlarged police patrol and heavy penalties for infractions of the laws and regulations, besides a heavy annual expenditure. Notwithstanding all precautions, occasional epidemics of typhoid recur.

Cement Drain Tile

(Continued from page 30)

inexperience in the business, the use of unfit aggregate, too lean a mixture, too little water or poor methods of curing. As a result the breakage in hauling has in many instances been altogether too great. After the tile have been laid in the ground they should increase in strength and they will not be injured by freezing and thawing if subjected to such conditions, as will soft-burned clay tile. This fact, though, should not be used as an argument in favor of poorly made cement tile.

It is only under unusual conditions that it will pay individual farmers to make their own cement tile. There are a number of good, small cement tile machines on the market by means of which it is possible to make first class tile. The process, however, is rather slow and the amount of hand labor required is so great that it is impossible to make any large number of tile with economy. If one is located some distance from a point where clay tile are handled and if a good aggregate is close at hand, conditions are somewhat altered, and it may be economical to attempt the home manufacture of cement tile. Again, if a large number of tile are to be used, and a good aggregate is close at hand one might afford to buy a large power machine and make the tile on a large scale. An instance is now in mind in which one farmer paid $500 for a machine and made enough tile to drain 300 acres of his own land and he still has some 500 acres to tile.

In a general sense the practice of taking one's time to construct an article made in a commercial way and on a large scale is questionable. Time is money now, to a greater degree than ever before. If what is wanted can be had on the market at a reasonable price, buy it. It will usually be of better quality than the homemade product and really cheaper if all things are considered.

This question invariably arises in the writer's mind—If good clay tile are to be had, why consider cement tile? A well-made clay tile will last for a hundred years—even longer. The average farmer can better judge the quality of clay tile than of cement tile. He, therefore, is not so likely to make a mistake in this respect. If good clay tile and good cement tile are to be had at the same price he will be less likely to err if he chooses clay product. On the other hand, if the cement tile are slightly less in price and he can satisfy himself as to their good quality, he may, with economy, choose the cement product. A good cement tile should ring clear when struck with a hammer. The surface material should not easily rub off and it should have a dense appearance and be free from cracks or checks. There should also be evidence of water marks on the surface, to make sure that they were not mixed too dry.

Some cement tile manufacturers make the claim that their tiles are superior to clay tiles because water will pass rather freely through the walls of the tile, whereas it cannot pass through the walls of a hard-burned clay tile. It has long been recognized as a fact that little water does or is expected to pass through the walls of a clay tile—it enters at the joints. It has not been demonstrated as a fact that this characteristic of cement tile is one to be desired.

The Rotary-Pole Magneto

(Continued from page 34)

The thing is a manifest mechanical impossibility. One remedy consists in mounting several magnetos, allowing each to fire its fair share of cylinders at 2,400 or 3,600 revolutions; but while that would do very nicely on the ground, the added weight is very serious in the air. By means of a so-called rotary sleeve, the armature magneto can be doubled up and made to spark four times per revolution; but this is the absolute limit, and it is not enough.

The rotary pole affords an escape from this dilemma. We are here no longer restricted to two or four flux reversals per revolution of the magneto shaft; we can have as many as we please. For the pole may be built out to make contact with the field-pieces, not merely in a single lobe, but equally well in multiple lobes. The wings of north and south pole must alternate around the shaft, and opposite each north-pole lobe must lie a south-pole lobe. Subject to these requirements, each pole may have as many lobes as we please to give it; there will be a flux reversal every time a north lobe is ousted from the critical position by its south successor, and vice versa.

So where the old system would have called for an 8-to-1 gear in firing an engine from a single magneto, the new, using a six-hole outfit, does the job on an 8-to-3 gear; and for other combinations there are corresponding reductions in the gear ratio. The explanatory diagrams show the simplest type, with a single lobe for each pole; the set-up of other types will be clear from the above remarks.

One more rather conspicuous advantage inheres in the rotary-pole magneto, without mention of which our story would be incomplete. The coil must be wound about the core through which the flux passes, or there is no current induced; so where the core rotates, the coil must rotate, too. But in the rotary-pole magneto the core doesn't rotate; it is way up in the bow of the magnets, quite out of the field save as the field is passed through it from the field-pieces. So there is no motion of the coil at all.

This simplifies the mechanical end of the outfit. When the coil goes 'round, we have got to pick the induced current off it as it shoots past; and for this we need brush contacts and complicated circuit breakers. But when the coil stands still while it produces the juice, we can pick the current off it with the simplest sort of devices, and do away with several troublesome and complicated moving parts.

Like the sewing machine and the telegraph and the harvester and every other good thing, the rotary-pole magneto did not "burst full panpolied from the head of Jove," Jove in this case being embodied in an American inventor, Charles T. Mason. There was the basic idea, patented in 1912; and ever since, as in the parallel cases mentioned and in many others, there has been a gradual process of improvement by accretion, for some of which the original inventor was responsible, but much of which was contributed by others. It was the stimulus given, both here and abroad, by the war that lent the final touches to the present high state of development attained by this ingenious apparatus.

Logging by Electricity

(Continued from page 34)

Aside from possessing no boiler and fuel-oil tank, the electric donkey does not differ greatly in appearance from the steam yarder. The motor and drums, of which there are three, are mounted on a heavy wooden sled. The main drum is driven by a train of three reduction gears, and has its ends filled with cement to deaden the noise.

The machine is now working at a distance of two miles from the power house. A permanent bare wire copper transmission line has been installed to serve the engine. The power is stepped up to 13,000 volts for transmission, and reduced at the scene of operations by a portable transformer to 550 volts. The motor takes its power through 500 feet of armored submarine cable, which can be laid with absolute safety through mud and water. This cable being wound with heavy steel wire, makes it rugged enough to be dragged through the brush, as occasion requires a change of location. The machine can be moved by its own power, by attaching its main cable to a convenient stump or tree. The transmission line has to be extended in the general direction of the change of setting, as the moving radius cannot exceed the length of the submarine cable.

To provide for communication with the crew at work in the woods, a signal wire attached to an air whistle on the engine, is run out to the point where the load is attached. A boy gives the requisite signals at the direction of the hook tender, by pulling on the wire. The electric logging donkey being far lighter than the steam machine, requires adequate anchorage fore and aft to keep it on the ground. As the accepted practice in the Pacific Coast woods is to run the main hauling line through a block on a spar tree, often over 100 feet in height, to keep the line free from obstructions, it can easily be understood how the machine has a tendency to lift itself off the ground. A few turns of spare cable connecting the sled with a convenient log or tree solves the question of anchorage.

Another contrivance, as yet lacking on the electric yarder, is a overload warning device, whose signal of alarm can be heard distinctly at a distance of several hundred feet, where the log is attached to the main line. Electric motors have no exhausts, to speak in eloquent terms when they are being overloaded. The logging motor is no exception. It pulls to its capacity and quietly stops. The rigging men, when working with a steam machine, can tell from the sound of the exhaust whether the load is too heavy or whether a stop is necessary to adjust the hitch, a thing not yet possible with the electric yarder. Engineers of the company are at work on a whistle arrangement, worked by an electric relay, which can be adjusted to function when the load reaches a prescribed limit of safety.

The advantages of the electric machine, where abundant power is available, are manifold. The electric motor as designed today, constitutes one of the most foolproof machines in general use. With the use of electricity the problem of piping water long distances to the engine is eliminated and the services of a fireman are dispensed with. Added to this comes a marked reduction in fire hazard.

The Return of Our Fleet

(Continued from page 33)

Grand Fleet that it dare not leave its harbors. As a matter of fact we are told by Admiral Rodman that the fleet was constantly out in search of the enemy, and that small detachments were sent to cruise near the German bases, in the hope of luring the High Seas fleet into the open. But he would not venture out.

The fleet was frequently under attack by submarines. Says Admiral Rodman:

"In our operations in the North Sea we were frequently attacked by submarines, and our battleships had numerous narrow escapes, often only by prompt and skillful handling. On one occasion a submarine rammed the flagship "New York," dented the bottom, and demolished the starboard propeller. But there is every reason to believe that the blows from the propeller sank the submarine. En route to drydock to make repairs and install a new propeller, three torpedoes in rapid succession were fired at her by hostile submarines. But again she avoided them by clever maneuvring and escaped. Once when guarding or supporting a convoy of thirty or forty vessels, on the coast of Norway, in mid-winter, a bunch of hostile subs fired six torpedoes at us. Again only our vigilance and instantaneous maneuvring saved us, but by a very narrow margin. There were still other attacks by submarines which necessitated quick action to avoid them.

"It would be superfluous to go into the details of our operations in the North Sea; or to mention the rigorous climate, where the latitude is north of Sitka in Alaska, or about equal to that of Petrograd in Russia; or the terrific weather, the cold, sleet, snow, ice and heavy seas; the arduous and dangerous navigation; the continuous cruising in close formation at high speeds, without lights, where the winter nights lasted 18 hours. Or the dangers of mine fields, our own sometimes, as well as those of the enemy; or the repeated attacks of hostile submarines on our battleships, and the never-ending readiness and vigilance of the whole fleet to put to sea on all but instant notice.

Always Ready to Fight

"Let it be sufficient to say that during our absence of a year there was no other condition than that of constant and continuous readiness for action. There was no liberty or leave worth mentioning; no one allowed away from the ships after dark, nor for a period longer than four hours, and then only in the immediate vicinity of the ship, in signal or telephone communication, subject to recall. All ships were completely closed and darkened from sunset to sunrise, as a precaution against air and other attacks; in winter this meant from fifteen to eighteen hours per day. This, in all but an arctic climate, was one of our many hardships. But there was no complaint; on the other hand,

every one seemed happy and contented, and all eager to go to sea every time the occasion demanded in the hopes that we would meet the Hun fleet and engage it.

"Let me add that with all of the demands which have been placed upon the ships of this division, in spite of this constant readiness for action, their maintenance, upkeep, and efficiency, under war conditions, with no general overhaul or repairs, have been maintained at such a high degree that it is no exaggeration to say that, were they called upon to do so, they could steam around the world as they are now and still be ready to go into action."

Realizing the absolute necessity of holding the German fleet innocuous within its harbors, Great Britain made vast additions to her fleet and rounded it out in every branch of its activity. Admiral Rodman refers to this fact as follows:

"To give an idea of the immense size and number of vessels employed in the Grand Fleet, it might be of interest here to state that, entering or leaving port, our column of ships, excluding destroyers, was on an average about sixty-five miles long; on one occasion, 76 miles. Its length was dependent upon weather and other conditions, as well as upon the number of ships."

If the whole destroyer fleet had been in single column astern the total line would have approached 200 miles in length.

All patriotic and broadminded Americans will be pleased to know that our officers and men who have coöperated with the Grand Fleet in the North Sea, bear tribute to the cordial sympathy and high appreciation which characterized the attitude of our great Ally during the combined operations. Testimony to this effect was given at a dinner on the "New York" in honor of Admiral Beatty, when Admiral Rodman said:

"It is truly impossible for me to express to you, the Commander-in-Chief, and flag officers of the Grand Fleet the pride and honor which I and my fellow countrymen of the 6th Battle Squadron feel for the great privilege which has been granted us of serving for the last year as an integral part of your force, under our most efficient, genial, and well-tried Commander-in-Chief, and with the others of the British Navy.

"It is needless for me to reiterate that which is known and recognized throughout the civilized world; namely, that it is the Grand Fleet which has been the very backbone of the structure, which has made a victorious peace a certainty. Without it the war would long ago have been disastrously concluded, with just the reverse conditions obtaining from those which now exist.

"In addition to indisputably emphasizing the value and necessity of sea power, and the command of the sea, the greatest lesson which this war has brought home to us is that, though we may have been born under different flags and are accredited as belonging to different nations, yet these are more a matter of geographic boundary or delineation than of real or important differences, and that after all the same blood flows through our veins. We have the same ideals of rights, morals, and national liberty, and that when the time came to show this to our common enemy, we could not only unite under a single leadership, but could coördinate and cooperate smoothly, easily, pleasantly, without the slightest friction, and yet have an efficient and well adjusted force, ready for any emergency or duty which it might be called upon to perform.

"I shall always look upon the year spent in the Grand Fleet not only as one of the most profitable, but particularly as one of the most pleasant and agreeable of a lifetime, and can only ascribe it to the never ending courtesy, help and assistance, which you, our Commander-in-Chief, and other flag officers, one and all, were ever ready to extend to us; particularly in the beginning, when we were more or less strangers to you and your ways, but who, if you feel as I do, have become more like true and well-tried friends, or even as brothers, between whom I trust and believe that the intimacy and affection which has been engendered by our mutual association and common cause will last forever afterward."

The Crucial Week for the Green Employee

MEN often get discouraged and quit the first month on a new job and do not analyze the cause of their failure. This article aims to discuss one universal reason for discouragement and failure in commercial and industrial life. A green man often labels himself as "Incompetent" because he doesn't understand the nervous readjustment that accompanies any change of occupation, nor does he foresee the crucial moments in this readjustment.

Every man in every occupation makes mistakes at the start. This is nothing to his discredit, providing he has profited by them and rearranges his mode of conduct so as to prevent the same mistake twice. The man higher up always extends the privilege of making one mistake; but woe to the man who continues to repeat it. Repeated blundering soon catalogues an employee as incompetent and he is fired or is relegated to some niche of mediocre service where his mistakes are not costly.

However, every man has had a week, we'll say the third, when every thing goes dead wrong. If they all had backbone enough to "stick" in spite of it, this discussion would miss fire; but thousands quit—only to swell our vast American army of floaters, lowering the standard of efficiency in every occupation. What is there about the third week that is unquestionably critical?

The routine of new work necessitates the formation of new habits. The process of habit formation is as essentially physiological as any other function of our material bodies. It has its basis in the most highly organized mechanism of man—the nervous system. The sense organs, coming in contact with the world about us, receive impressions. These impressions are transmitted to nerve centers in the brain or spinal cord, and action results. If the message transferred is dependent on the brain for interpretation, the process is conscious; if the process is reflex, a lower brain center, perhaps the spinal cord, handles it with no thought on our part. To form a habit is to transfer the circuit to a lower brain center and relieve the higher mental faculties for new work. The transfer takes place after the same pathway has been used so often that a stimulus meets no resistance when it excites the nerve ending.

Nervous tissue is very plastic and readily yields to repeated stimulation. But from the time we start to form a habit until it is absolutely part and parcel of our body, there are dangerous pitfalls for the individual. The most critical time is when we must judge whether or not we can trust the lower nerve centers to carry out our work. Too much new stimulus forces us to crowd unripe habits into the subordinate centers of control. What happens? They function inefficiently, we make mistakes, call these new habits back to consciousness, confusion results, and we get discouraged.

Learning to operate a typewriter, an adding machine, a lathe, a crane, or anything else, means not only one readjustment, but thousands—hence the significance of the problem. We must not try to let our new habits do the work before they are grown-up. If an employee can cross this plateau of uncertainty in forming new habits, the battle is half won. If an employer can understand the stress and strain of this period for the employee, he will often develop a valuable man instead of losing his temper and firing him.

If you are a learner, strive to attend to the routine until the habit is thoroughly ripe; if an employer, take the "third week" into account and help the green man.

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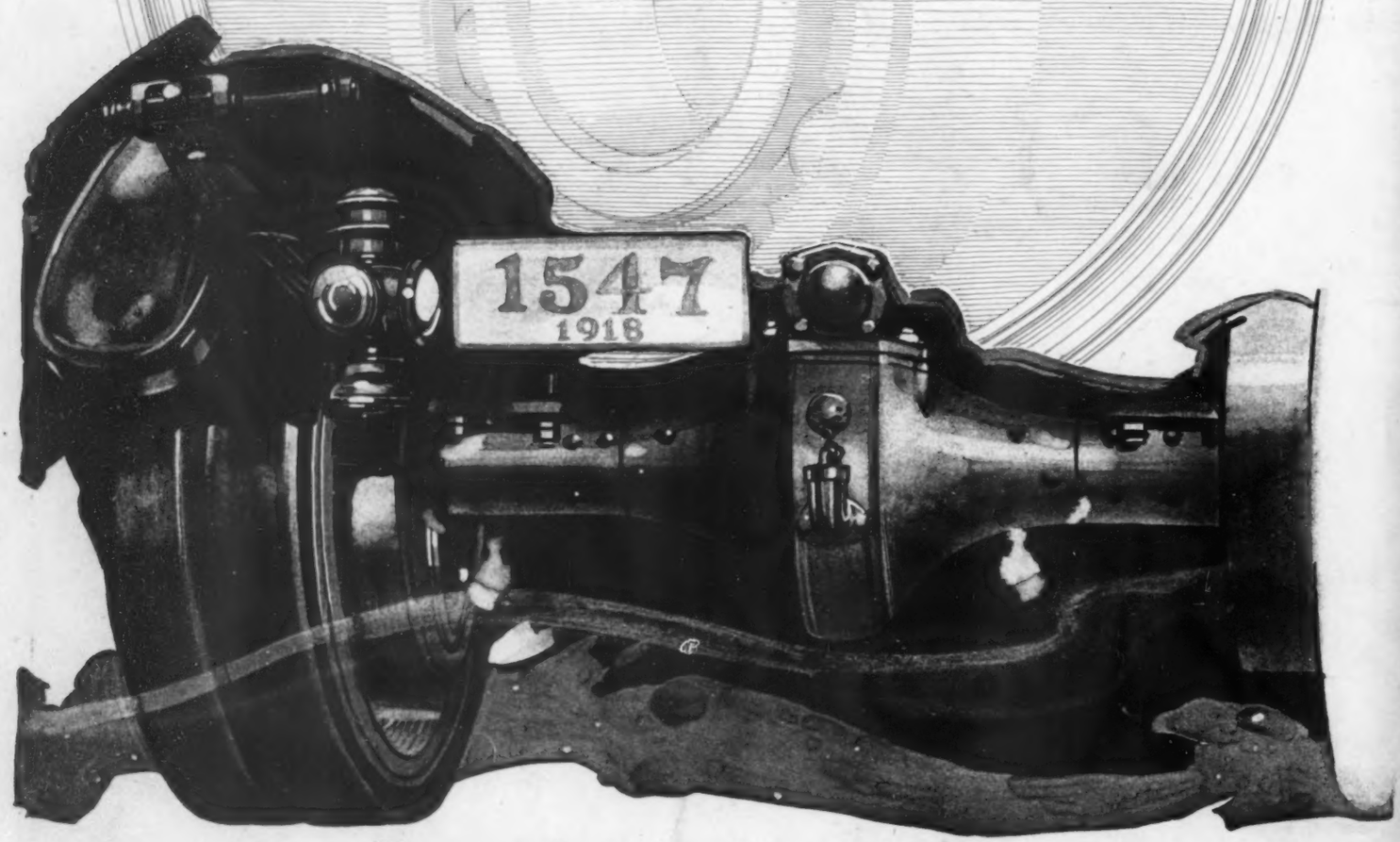

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